ELECTRICAL REVIEW

[ILLUSTRATED.]

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Rankin Kennedy's New Dynamo.

Prof. Jamieson has been making some tests recently of the single horseshoe magnet type of dynamo lately introduced in England by Rankin Kennedy, illustrated on this page. The machine in question was a 10-unit one, running constantly from dusk till daylight. Prof. Jamieson says:

"I tested this dynamo on Friday, the 4th November, 1887, and had it run continuously for eight hours at full load (with the exception of about half-an hour during the workmen's meal hour). The dynamo, which is a self-regulating, compound-wound machine, consists of a single horseshoe magnet, with an armature of the Gramme type. The core of the magnet is made of soft-hammered scrap iron, the pole-pieces of hematite cast-iron, and the armature core of soft charcoal iron washers. The whole machine is exceedingly simple, strong, well-proportioned, and well put together. It is just the kind of dynamo for factories, mills, workshops, and steamers, for it may be left in charge of any ordinary mechanic or fireman, with a minimum chance of its getting out of order. All the adjustable parts are readily accessible, and the armature may be removed and replaced in as short a time as, and with less trouble than, almost any form of dynamo that I have seen. There is no perceptible sparking at the brushes. The commutator and the brushes, both from their construction and composition, as well as the freedom with which the latter can be adjusted, are calculated to last for a very long time None of the parts of the dynamo showed any signs of undue heating, and the ventilation of the armature was all that could be desired. The dynamo gave an 'output' of 10,850 watts or 108.5 amperes, and 100 volts at 620 revolutions per minute, and the electrical efficiency was 89 3 per cent., which is good for a dynamo expressly designed as a cheap, practical, work-shop or factory machine, and not as a special test dynamo for experimental purposes. With due attention to the oiling of the bearings, etc., there is no reason why this machine should not work continuously for a week or more on end, without giving the least trouble; and if the future machines made by the same firm are as carefully designed and constructed as the one I had the pleasure of testing, they should give satisfaction to the purchaser. It is a distinct improvement on their former dynamos."

Improvements for Paper Mill Lighting.

While in Lancashire the other day, observes a correspondent, we obtained the following details of improvements which have been introduced, specially for paper-mill lighting. An improved double vitrified cleat, the use of which insulates the cables from the damp beams, etc., thus preventing loss from breakage; an improved manner of protecting the cables and wires from the action of chlorine, which is so prevalent in many portions of paper mills, and which, by its action on copper or brass, very soon causes the wires to be reduced in size, with a consequent resistance to the passage of the current. The covering which he uses, and which is his own improvement, entirely prevents this.

An Interesting Contribution to the Lightning Rod Question. By Major Heap, of the U. S. Army.

To the Editor of Electrical Review:

The subject of protection from lightning has of late been considerably discussed, and I have read with interest several articles on lightning-rods in the ELECTRICAL REVIEW, and other papers.

There are three qualities which a good lightning-rod should possess—ease of discharge, first rate conductivity throughout its entire length and excellent ground connection. This last, probably the most important of all, is the most frequently neglected.

An excellent lightning conductor can be erected as follows:

Take a copper rod half an inch in diameter and three feet long, in one end make two saw cuts in the direction of its length six inches long and at right angles to each other: bend out the four pieces thus formed about thirty degrees, file their ends to sharp points, and plate them with nickel.

Fasten this rod securely with copper staples to the highest part of the building so that it will project about two feet, to the lower end rivet and solder a copper ribbon one-eighth of an inch thick and one and a-half inches wide; lead this ribbon in the most convenient way on the outside of the building to the ground, fastening it to the building with copper nails. The ribbon will have to be made of necessity of a number of pieces which should be securely riveted and soldered together.

Select some convenient spot near the building where the earth is always damp, and, if possible, where the waste water from the roof or elsewhere would naturally run; here dig a pit about three feet square, and to moist earth, not less through than three feet deep; put in the bottom a well-rammed layer, one foot thick, of gas coke; in one corner of the pit, resting on the coke and partially imbedded in it, set a piece of six inch gas pipe long enough for the upper end to project above the surface of the ground, fill it also with well-rammed coke to within six inches of the top.

Then wrap a piece of coke with a strip of copper ribbon, dip the coke and ribbon in melted lead so that there will be a good connection between them, and insert them into the gas pipe, leaving the end of the ribbon projecting, and fill up with coke.

To this projecting end rivet and solder the ribbon leading from the building and fill up the pit with earth.

All the rivets must be of copper, and no insulators must be used.

This lightning conductor will protect a conical space whose base is equal to the height of the upper point of the conductor from the ground.

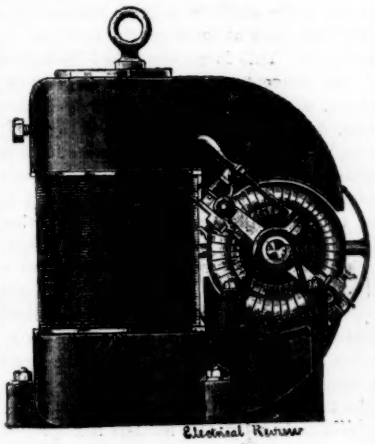
The copper ribbon, being easily bent, can readily be adapted to the irregularities of the building and has less self-induction than a round rod. The coke ground connection is better than a metal plate, it has great surface, depolarizes itself, does not corrode, and is cheap.

DAVID PORTER HEAP.

Tompkinsville, N. Y., Jan. 8, 1888.

A New Therm-Ammeter.

Prof. A. K. Eaton, of Brooklyn, has taken an ordinary metallic thermometer and converted it into a therm-ammeter. He does this by insulating the parts in such manner as to pass the current through the spiral which produces the movement in an ordinary metallic thermometer. The current heats the spiral and produces a corresponding movement of the index which indicates the amount of current in amperes. This can be used for either continuous or alternating currents. He has also produced a modified form of the therm-ammeter by the use of



RANKIN KENNEDY'S NEW DYNAMO.

the common thermometer with cylindrical bulb, around which is coiled a spiral of narrow German silver ribbon. The current in this case is passed through the ribbon and the heat of the current is shown by the rise of the mercury. The amount of this rise indicates, of course, the current strength in amperes. The spiral ribbon is protected from radiation of heat by non-conducting material. Numerous layers are used. This can be used as a meter in almost any kind of work in which the current is allowed to pass continuously through the spiral. It is not well adapted for quick measurement, because it takes five minutes or more to rise to its maximum, but having reached that point any variation in the current will be at once indicated by the rise or fall of the mercury.

Illuminated Watch Dials.

A Swiss watch maker has invented an electric illuminator for watch dials. A small electric lamp is fitted in the watch case, where it will light up the dial, when, by touching the case with the charm, connection is made through the chain with a small battery carried in the waistcoat pocket.

Don't You Think They Were Justified?

We understand that several electric meters have been invented recently. We have not seen any of them, but we hope the electric people will adopt some sort of meter that can defend itself against calumny. We have known consumers to stand up and call the common gas meter a liar to its face.—*Progressive Age.*

Electrical Measurements, Especially as Applied to Commercial Work.

BY PROF. WM. A. ANTHONY, BEFORE THE FRANKLIN INSTITUTE.

The subject I have chosen for this evening's lecture is one of the driest that could well have been chosen, but I have believed it to be of sufficient importance to warrant its presentation to an audience such as I suppose would be attracted to the Franklin Institute meetings. Thousands of men and millions of capital are to-day interested in the applications of electrical science. We have come to a point where hap-hazard work is no longer admissible, where electrical currents must be gauged and measured, where the electrical properties of materials must be accurately determined, where, in short, machines and apparatus must be built to a gauge, and their products measured electrically as well as mechanically. As, in mechanical construction, we have gone beyond the use of the foot-rule and carpenter's square, and are fixing our dimensions by standard gauges to the ten-thousandth of an inch, so, in the electrical construction, we have gone beyond measurements by rude and imperfect instruments, and have got to a point where, if our machine and apparatus are to find their place in the markets of the world, we must gauge our work by accurate electrical standards.

What are the electrical quantities we have to measure? Before attempting to answer this question, let us consider for a moment the origin of the terms we shall have to use. Our electrical nomenclature has been derived from the fluid theory of electricity. We talk about an electrical current as though something were flowing; we talk about quantity of electricity as though we considered it something to be weighed or measured; we talk about capacity for electricity as though a body could be filled with and hold a certain quantity of it, as a vessel may be filled with water. Whence comes the idea of an electric flow?

If we go back to the early electrical experiments, where insulated bodies were "charged" and then discharged—the electricity drawn off, as it were—by a wire connecting the insulated body to the earth, we see that the idea of something accumulated in the body and then conveyed away by the wire was a very natural one, and when we found that the wire was heated, the passage of something through it seemed to be proved. Then came the voltaic battery and the evidence of greater and greater effects as the cells in series were increased, a close analogy to increasing pressure, causing a more rapid flow of fluid, it was seen that many cells in series gave power of overcoming obstacles, that insulation had to be more perfect to prevent escape; hence the terms high tension and low tension, as these were applied to gases.

There is some misapprehension among those who have had only a practical acquaintance with electrical phenomena and do not know the fundamental principles. I hear a great deal of talk about high tension currents and low tension currents, as though the currents themselves were different. It should be understood that a current of one ampere

is always a current of one ampere, always conveys one coulomb per second, whether the tension be high or low, just as a stream that conveys one gallon of water per second is the same stream, whether under high or low pressure. The term tension is a misnomer, as applied both to electricity and to gases. Pressure is the proper term for gases, and may be used by analogy for electricity. Potential is the scientific term for the electrical condition for which the word tension has been used. We can best understand it by drawing the analogy between it and fluid pressure. We find in the evening that the gas is burning dimly. We say at once, too little pressure in the mains. If more pressure is put on, more gas is forced through the burners and our lights burn more brightly. If our incandescent lights burn dimly, it is a lack of potential. Let the potential in the wires be increased, more electricity is forced through the carbon filament, with an improvement in the light. It is not the greater pressure that gives you the brighter gas light, but the larger quantity of gas that the greater pressure supplies. So it is not the increased potential that causes the increased brightness of the carbon filament, but the greater flow resulting from the higher potential.

The electrical quantities we wish to measure are then quantity, which is measured in units called coulombs, and may be considered as analogous to pounds of a gas or liquid: potential, measured in volts, analogous to pounds per square inch of fluid pressure: capacity, measured in farads analogous to cubic feet of a vessel for holding fluids: and strength of current measured in amperes, for which there is no close analogue in fluid measurements. Yet in electrical measurements, strength of current is, perhaps, most important of all, and furnishes the fundamental unit of the system. Another quantity of great importance in electrical measurements is the resistance of bodies to the flow of electricity. It is measured in ohms and may be compared, qualitatively, to the frictional resistance which fluids experience in flowing through pipes.

Let us consider now these several quantities and their relations to each other, from the standpoint of the analogy of a flowing fluid. Here is a pipe carrying gas. We wish to know how much gas is flowing through it per hour or day or month. This the gas meter professes to tell us, but there is sometimes a question whether its statements are truthful. We could run the gas into a suitable vessel and measure it, but that would be inconvenient in the practical use of the gas, because we consume it as it flows. But whatever method we use, our object is to determine the total quantity of gas delivered in a given time, and not the rate of flow at any instant. By rate of flow I do not mean the velocity of the gas, but the rate as indicated by the quantity of gas flowing in unit time when the flow rate is uniform. In this sense, when the same quantity of gas per minute is flowing, the rate of flow is the same, whatever the size of the pipe. But there is no important effect of the gas dependent upon the rate of flow; the pipe that conveys it acquires no new properties or powers. In fact, no effect is produced by it that would indicate to us whether the gas were flowing or not. To be sure, heat is generated by the friction of the gas, but in practice this is too small to be perceived and is of no consequence. Moreover, the heat generated is a function of the velocity of the gas, and not simply of the rate of flow, as I have used that term. We have, therefore, no need to know the rate of flow of a gas, we make no attempt to measure it directly, we have no unit in which to express it, and no distinctive name for it as a quantity.

Now let us compare an electric flow. Here is a wire conveying an electric current. We know there is something going on it, because we see the effects on beyond, just as we know that gas is flowing in this pipe because we see it burning in yonder burner. As with the gas, we can determine the quantity of electricity flowing in a given time by measuring its effects. Electricity flowing through acidulated water generates hydrogen and oxygen gases. The quantity of these gases generated in a given time may be taken as a measure of the total amount of electricity flowing. Electricity flowing through a solution of a metallic salt, as copper sulphate or silver nitrate, deposits the metal. The weight of deposited metal will measure the total flow. But these methods, like the methods of measuring gas, tell us only the average rate of flow, and not the rate at any given time. But, a conductor conveying electricity, unlike a conductor conveying fluid, exerts forces due to the current in it. This wire will deflect a magnetic needle, will attract iron filings. (Shown by experiment.) In short, it develops all around it a magnetic field.

The true ampere is based upon the absolute unit current as defined by the British Association committee. The absolute unit current is that current, a centimeter length of which will produce a unit magnetic field at a centimeter distance, or it is that current which, when flowing in a conductor bent into a circle of one centimeter radius, will develop at its center a magnetic field of intensity 2π. This is the foundation of the electro-magnetic system of electrical measurements. Upon this unit are based all the other units of the system. The ampere is one-tenth of this unit. This was the value of the weber, the former name of the unit of current, and the Paris congress, in changing the name to the ampere, did not change its value, but expressly voted that this should continue to be its signification.

Now to measure an electric flow in amperes. We may bend the conductor into a circle and compare the field produced at the center of the circle with some known magnetic field, such as the magnetic field due to the earth. This is accomplished by means of the tangent galvanometer. The conductor, of one or many circular convolutions, is placed with its plane in the magnetic meridian; in this position the force it produces is at right angles to the earth's magnetic force, and a little needle placed at the center of the circle will take a position depending on the ratio of the two magnetic fields. If the needle stand at 45° with the magnetic meridian, the two fields are equal, and, in general, the ratio of the field produced by the current to that of the earth, is the tangent of the angle that the little needle makes with the meridian.

In the great tangent galvanometer of the Cornell University, this method is employed to measure currents up to 3.0 amperes. The great difficulty in this method is that the earth's magnetic field is not constant, but varies from day to day and from hour to hour. In all work where accuracy is aimed at, the horizontal intensity of the earth's magnetic field must be determined at the time of making an observation for current. In the Cornell instrument a coil suspended by a wire serves to determine the horizontal intensity by balancing the force developed by a current in the coil in the earth's field against the force of torsion of the suspending wire. But another and more serious difficulty is met with when any attempt is made to use this method for ordinary practical work. The earth's magnetic field is greatly affected by the presence of magnetic substances. A small mass of iron is sufficient to change very greatly the value of the earth's field in its vicinity. A large magnet or a dynamo may at many feet distance change the earth's field by a hundred per cent. The tangent galvanometer can only be used, therefore, where there are no disturbing causes. It cannot be used in a dynamo station or in a workshop. But in a suitable place, it is invaluable as a standard with which to compare other instruments. The Cornell tangent galvanometer is mounted in a special building, constructed entirely without iron and placed at a distance from all other buildings. The earth's field there is subject only to such changes as are due to natural causes, and with the appliances for determining these changes the highest class of work can be done.

We need, however, instruments for measuring currents in the workshop and about dynamo machines, and a great variety of instruments called ammeters have been constructed for these purposes. In general, such instruments consist of a coil of wire developing a magnetic field which is compared with an artificial field produced for the purpose, or the magnetic force developed by the coil in the presence of some other magnetic field is balanced by some known force. To be more explicit, one form of ammeter consists of a coil which tends to deflect a needle against the artificial field of a permanent magnet. The accuracy of these instruments depends upon the constancy of this opposing field. But no permanent magnet does remain constant, and these instruments, therefore, need to be frequently calibrated. Another form of ammeter is one in which the coil acts upon a mass of soft iron, developing a force which is opposed by a spiral spring. Here the accuracy of the instrument depends upon the constancy of the spring and upon the constancy of the effect of the little mass of iron.

Speaking of this fact, of the necessity of two magnetic bodies to develop a magnetic force, reminds me of a question often asked in regard to extracting particles of steel that have become imbedded in the eye. Would not a sufficiently powerful magnet draw it out? I always tell the questioner that the most powerful magnet in the world could exert but a small force upon a little particle of steel. If you can loosen the piece of steel, a magnet is a very good means of taking it out of the eye, but then a small magnet does as well as a large one. I was once told by a gentleman that he had known of a sewing needle that was deep down in the flesh of the leg being drawn out by the application of a powerful magnet. I remembered how little force the most powerful magnet can exert where a sewing needle is the body attracted, and thought to myself that the statement needed confirmation. Some of you will remember that when it was proposed to build the 1,000 feet iron tower in Paris, it was predicted that all the loose iron articles, knives, joiners' tools, chains, tin pans, to say nothing of wagon tires and horse shoes, would come rushing pell-mell to the base, in consequence of the tower becoming a great magnet by the earth's induction. Yet, notwithstanding the prediction, I do not think I should take the precaution to leave my keys and pocket knife this side of the water if I were going to visit Paris after the erection of the great tower.

But to return to our ammeter. The little mass of iron is attracted by the coil, because it becomes itself a magnet. If it become a strong magnet, it is attracted strongly; if it become a weak magnet, it is attracted feebly. Its magnetic strength will not be the same under all circumstances, and the force exerted by the coil upon it is, therefore, not always the same when the same current is flowing. I have recently re-calibrated an Ayrton and Perry instrument of the permanent magnet type, and found its constant had changed sixteen per cent. since last March. Last spring I calibrated two spring ammeters at the same time, and found one to read five per cent. fast, while the other was nearly as much slow.

Do not understand from this that I consider these instruments of little value. They are the best we have. What I want to impress upon you is the importance of frequent comparison of the instruments with others known to be standards. Theoretically, the best ammeter is one in which the force exerted between two coils in the same circuit is opposed by gravity. Here the force developed depends only upon the current which it is desired to measure, and the opposing force is the one force at our command that does not have to be watched and tested, but is the same to-day as yesterday, and can be trusted to be the same to-morrow as to-day. Such an instrument would, therefore, give uniform indications. (Thomson instruments exhibited.) There are, however, practical difficulties in the way of constructing such an instrument for the measurement of large currents. One of the coils must be movable, and it is difficult to take a large current to and from it without imposing some constraint upon its motion. We still want for commercial use a really good ammeter for measuring large currents, one that we can trust as we trust our scales for weighing merchandise, to give correct indications for weeks and months and years.

But the measurement of currents or of quantities of electricity is but a small part of what is required in electrical measurements. Potential in many cases is quite as important an element as strength of current or quantity. To go back to our analogy of a flowing fluid, we know that pressure is necessary to bring our gas to the burners, but so long as it is sufficient to supply gas in proper quantity and gives us a good light, we do not trouble ourselves about it. It is the business of the gas company to maintain the required pressure, and they must adjust by a pressure gauge. It is the chemical energy of the gas that gives the light, and the energy due to the pressure is too small an item to be considered. But suppose we are supplying steam or compressed air for driving engines, the pressure is now a more important item. The power used is the product of pressure by volume of steam used per second. Pressure is, therefore, one of the items that the consumer pays for. Where electricity is supplied for any purpose, the energy which the consumer pays for is the product of potential by quantity. Varying either factor varies the energy delivered, and measurement of potential is, therefore, as important as measuring quantity or current. The unit in which we measure potential is based upon the relation just stated, that the product of potential by quantity gives the electric energy. The absolute unit potential is the potential under which the absolute unit current performs the absolute unit work in unit time. A true volt is 100,000,000 absolute units.

I have, so far, avoided the use of the term electro-motive, for I find there is a good deal of confusion as to the exact use of it, even among physicists. I find it stated, in some works of high authority, that electro-motive force and difference of potential are synonymous terms, and again, that difference of potential produces electro-motive force. I have seen it stated, in a very excellent text-book on electricity, by one of our foremost electricians, that the electro-motive force of a voltaic cell is the result of the difference of potential between the poles.

I can best illustrate what I conceive to be the difference between the two terms by referring again to the analogy between the electric flow and the flow of fluids. Gas is flowing through this pipe. Take two points A and B, and suppose the flow to be from A toward B. A pressure gauge would show a higher pressure at A than at B. Water flows in your water mains. A pressure gauge will show a higher pressure at any point than at any other point further on in the direction of the flow (it is supposed that the points considered are at the same level). The difference of pressure is the cause of the fluid flow. It is the force that moves the fluid, the fluid motive force. Electricity is flowing along this wire.

I have shown that there is a difference of potential between the different points along the wire, and we accept that difference of potential as the cause of the electric flow between the two points. If we know nothing of the pipe except between the two points considered, we cannot assign any other cause for the flow of the fluid through it except the difference of pressure, but we know the difference of pressure must have a cause, and if we are at all inquisitive we shall not be satisfied with saying the difference of pressure is the fluid-motive force, but we shall trace the pipe back and try to discover the cause of the difference of pressure. Tracing the pipe back, we find, by and by, a stand-pipe in which the water level is far above any of the outlets from which water is drawn. This accounts for the pressure of the water in the pipes, but still we are not satisfied. There must be a cause for the high level in the stand-pipe. Investigating further, we find a system of pumps which forces the water into the stand-pipe, taking the water, perhaps, from the same level to which our pipes discharge it. Here we find a water-moving force that is not water pressure, without which the pressure that moves

the water in our pipes would soon cease, and the flow stop.

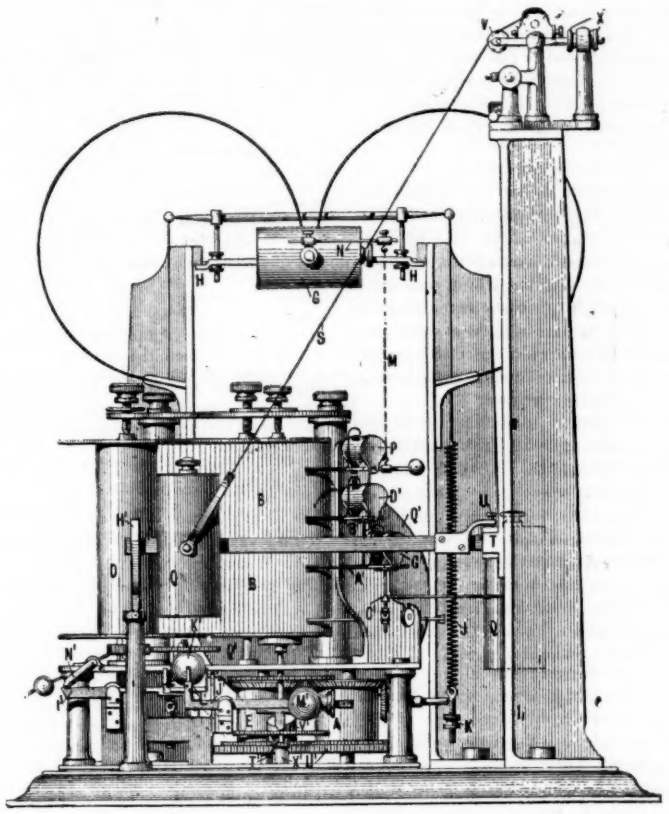
Suppose now that all our outlets are stopped and that no water flows from the stand-pipe. What results? The pumps go on working, the water in the stand-pipe rises higher and higher, and if the pipe is high enough and strong enough, the water will rise till the force of the pumps is balanced, and they will stop. The pressure now exerted by the water column measures the water-moving force of the pumps. We can tell by it just what is the force we have at command for moving water. This force is the water-motive force of our system. It must be sufficient to overcome the resistance of our pipes and carry the water to the highest levels we wish to reach when the flow is most rapid. Open a cock, the water flows and lowers the level in the stand-pipe, the back pressure upon the pumps is diminished, they begin to work, and maintain the water at nearly its former level. Open another cock, the level falls a little more and the pumps work faster. Make more and more openings, and the water in the stand-pipe falls more and more, till, by and by, the level in the pipe is but little above that of the supply from which you pump. Water is being used at such a rate that the force of the pumps is little more than sufficient to drive the water through their own passages. It is not the water-motive force that has failed, but the carrying capacity of the pumps.

Now note the analogy in the case of the voltaic cell. We have found on this wire a difference of potential from point to point. Trace the wire back and we find an apparatus whose office it is to maintain the potential difference. What is its action? By some means, which we do not understand as well as we understand the action of a water pump, this apparatus takes electricity from one of the plates, *N*, in the liquid, and forces into the other, *P*. In the second plate, *P*, the electricity is at a higher level, and so flows through the wire to the plate *N* to be forced back to *P* through the liquid. Cut the wire and almost at once the electricity in *P* reaches the highest pressure, level, or potential, that the cell can produce. All action in the cell ceases, and the difference of potential between it and *P* now measures the force the cell can exert to move electricity, the electro-motive force of the cell. This electro-motive force is something that depends upon the materials of which the cell is made, and is absolutely independent of its size. The smallest cell, one made of a copper musket cap holding a drop of water, and a bit of zinc of the size of the point of a pin, as I have often shown experimentally, has the same electro-motive force as a cell of the same materials of the largest size; just as the water-motive force of a small pump, its power to produce pressure, may be just as great as that of a larger one. Let us follow the analogy. I connect *P* with *N* by a small wire. This is like opening a single stop-cock on our water service. The electric level is lowered, but the cell begins to work and maintains the potential at very near its highest value, another wire allows more electricity to flow, still more lowering the potential, and it is possible to open so free a path for the passage of the current, that the cell can no longer maintain a considerable potential difference, and the limit of the capacity of the cell to supply electricity is reached.

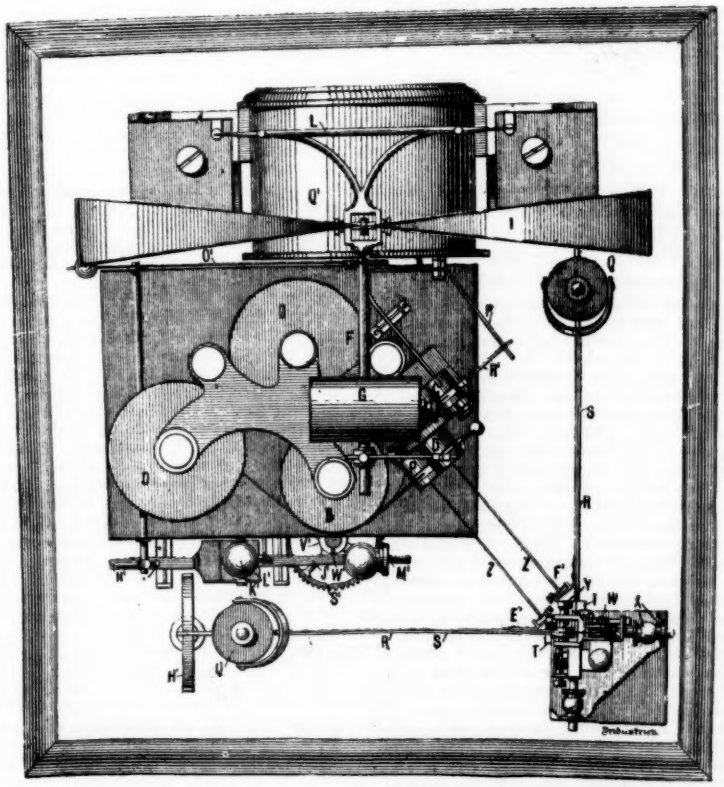
Note that the limit here is not due to any falling off of electro-motive force, but to the fact that nearly the whole electro-motive force is required to carry so much electricity across the liquid from plate to plate. Here exactly is the advantage of a large cell over a small one—a large cell, like a large pump, can maintain a high pressure even when there is a large draft upon it. I think you will now see the distinction between the terms difference of potential and electro-motive force. Difference of potential is one electro-motive force. But the general term, electro-motive force, includes all causes of the movement of electricity. There may be a flow of electricity without a difference of potential, but there can never be a flow without an electro-motive force.

Take the simple case of a rotary motor. (Rotary motor on blackboard.) Let it run at full speed and suppose there is no friction. It offers no resistance to the flow of the water. The water flows with the same velocity as though the motor were not there, and it does no useful work. Begin now to load the motor, you check its speed and at the same time check the flow of water. As you increase the load you check the flow more and more. The force exerted upon the motor will be greatest when it is brought to rest, and the flow in the pipe stopped; then the water will exert its greatest pressure, but since the motor does not move, it can do no work. Between these two conditions of no power to do work, when moving with the full velocity of the water, but without force, and when receiving the full pressure of the water without moving, there must be a condition of maximum power, or maximum rate of working, and we can readily admit that this occurs when the back pressure of the motor is half the water-moving force. At this speed half the water-moving force is effective in running the motor and half goes to waste in the velocity with which the water leaves the motor. The efficiency of the motor is, therefore, only fifty per cent. It would be far better, if so much power is needed, to use a larger motor and run it at slower speed and at less than its maximum power, and let less of the energy of the water to go to waste.

Now, note the analogy between this and the electric motor. When the electric motor is running it develops a counter electro-motive force which corresponds to the back pressure of the water motor. When this counter electro-motive force equals half the electro motive force of the generator, the electric motor is giving its maximum power; but it is using only half the energy of the electric current, the other half going to waste in developing heat in the conducting wires leading to the motor, and in the motor itself. Just as with the water motor, it is better to use a larger size electric motor and let it run at such a rate that it will develop a counter electro-motive force equal to more than half the electro-motive force of the generator, and while developing less than its maximum power perform a work equal to a larger percentage of the energy given to it. The difference between the water motor, which I have taken for an example, and the electric motor, is this, that while the water motor exerts the greatest back pressure when it is stopped, the electric motor exerts the greatest counter electro-motive force when it is running at the highest speed. Otherwise, the analogy between the working of the two is very close, and the efficiency of either one of them is exactly the ratio of the back pressure which it exerts to the possible pressure which can be brought to bear upon it.



FRONT ELEVATION.



GENERAL PLAN OF GRAY-MILNE SEISMOGRAPH.

In bringing this lecture to a close I wish to acknowledge my own obligation to Mr. Ives, who has kindly loaned and operated his lantern for projecting the views on the screen; to J. W. Queen & Co., for the loan of nearly all the apparatus used and exhibited here this evening, and to Mr. C. H. Richardson and Mr. Metzgar, of the firm of Richardson & Metzgar, who have given their services for the whole day, with the resources of their workshop, for the preparation of the apparatus for the experiments. Without their assistance the preparation of the experimental illustrations would have been impossible. Thanking you for your kind attention, I now close.

The Gray-Milne Seismograph.

The apparatus which is illustrated herewith, was designed to record the amplitude, direction, period, and time of occurrence of the motions at a point on the earth's surface during the transit of an earthquake. A knowledge of the amplitude, the period, and the prevailing direction of these motions at any place is of great importance, as furnishing data for the design of structures to be erected in that region. A knowledge of these elements for earthquakes, which have produced damage to structures of known design, is also valuable as furnishing experience for future work. The direction of motion has also in itself some interest, because it gives, under certain conditions, an idea of the direction of propagation of the disturbance. The most valuable element of the record for this purpose is, however, the time of occurrence. When this is known with accuracy at a few places, it is easy to form a fairly accurate judgment as to the position of the center of disturbance.

This apparatus in its most recent form is shown in elevation and plan in the accompanying illustrations taken from *Industries*, and consists of the following parts: (1) A set set of clock-work mechanism for driving at a continuous and uniform rate a record receiver, which, in the form here illustrated, consists of a band of thin paper of sufficient length to take a week's records; (2) a vertical component and two horizontal component recording pendulums; (3) a timepiece, compensated for temperature and adjusted to keep accurate time, for recording equal intervals of time on the record receiver, and from these the time of occurrence and other time elements of the earthquake; (4) an automatic change speed apparatus, by means of which the rate of feed of the band of paper is increased at the time of an earthquake and again reduced to its normal amount after a certain time. The mechanism for feeding forward the paper consists of a train of wheel work driven usually by a weight, and, for reasons which will appear when describing the change speed mechanism, governed by two governors placed at different distances from the driving power. The cord barrel from which the main train of wheel work is driven, and the drum which governs the speed of the paper, are shown at *A* and *B* in the illustrations. The paper is held on a supply drum *C*, and is carried forward round the drum *B* and wound on a receiving drum *D*. Tension is kept on the paper by means of a short train of wheel work driven from the barrel *E* and terminating at the receiving drum *D*. The necessary back pull on the paper is obtained by applying friction to the bearings of the supply drum *C*. The supply and receiving drums are made interchangeable, so that when the paper has been completely transferred from the drum *C* to the drum *D*, all that is necessary is to interchange the drums, when the instrument is again ready for use; the record in this case being written on the other side of the paper ribbon. Should no earthquake occur during either of these intervals, the paper may be used over again a considerable number of times, the drums being simply interchanged shortly before the paper runs out. A spare supply drum is provided with the instrument and can be kept ready for use, so that, should it be found desirable to examine the week's records before again using the paper, it can be substituted for the one which has been emptied. It is sometimes desirable that a record should be cut out before the paper has completely run through, and to make this operation easy, the drum *B* is driven through a ratchet and pawl so that the paper can be quickly run back by hand to the desired place, the part containing the desired record cut out, and the parts gummed together again.

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GEO. WORTHINGTON, - - - Editor.
CHARLES W. PRICE, Associate "
T. J. McTIGHE, Electrician and Manager Patent Bureau.
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS, GEO. A. HAMILTON, } Consulting Electricians.

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EDITORIAL ANNOUNCEMENT.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill., will represent the REVIEW in the West.
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NEW YORK, JANUARY 21, 1888.

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St. Louis is discovered as the possessor of the liveliest gas meter on record. It jumped from $3 for a month's consumption to $6, and the month following metered off $36.75 worth of gas, and this in a house occupied by one person and where only one gas jet was in use. We think Chicago gas meters will hang their heads in shame.

By the Lowell fire Thursday morning the fire alarm telegraph system was completely destroyed, and alarms can be given only by telephone. It will be several days before the system can be replaced. The fire telegraph system was considered very perfect, $2,000 being expended recently in its improvement. The loss to the city is not less than $50,000; no insurance.

The list of papers to be read before the Electric Light Convention in Pittsburgh next month (published in the REVIEW last week) gives promise of making the convention an instructive and important occasion. One of the prominent features in the success of this growing organization has been the promptness with which live, practical topics have been taken up and fearlessly discussed.

Among the patents in January will be found the electrical stove of Prof. Barrett and J. F. Mehren, the original of which was described in the REVIEW a year ago or more. Barrett says it was the outcome of a necessity. The Mayor had cold feet and wanted an electrical stove to replace the gas stove which the electric lights had robbed him of, and threatened the Professor with immediate discharge and disgrace. The electric stove had to come—it was a ground hog case.

Major David Porter Heap, of the United States Lighthouse Board, gives some valuable points on lightning-rod construction, in another column. There has been a good deal of discussion over this question in both the daily and scientific press, caused by some recent criticisms in the REVIEW on the poor work done by lightning-rod men, and the uncertain protection resulting. We think the "practical" lightning-rod man can read Major Heap's communication with much benefit to himself and to his patrons.

The report of the commission appointed by the Legislature in 1886 to report the most humane and practical method known to modern science of carrying into effect the sentence of death in capital cases, was transmitted to the Legislature yesterday. It recommends killing the culprits by electricity. The commissioners are Elbridge T. Gerry, Alfred P. Southwick and Matthew Hall. They present letters on the question from Mr. Edison and Prof. Thomson, and give the result of a number of experiments in killing dogs by electricity.

The commission recommends that a chair, with a head and a foot rest should be used, in which the condemned man could be seated in a half-reclining position. One wire could be connected with the head rest and the other with the foot rest, which would be a metal plate. The electric current could be supplied by electric light wires. An independent line from the electric light plant could be constructed, if desired. The cost would be nominal. Places of execution could be established at the State prisons at Auburn, Sing Sing and Dannemora. Circulars were sent by the commissioners to Supreme Court Judges, County Judges, District Attorneys and Sheriffs, throughout the State, asking opinions on modes of executing criminals. Out of two hundred replies eighty favored hanging and the remainder were in favor of a change. Eighty-seven were in favor of electricity, eight preferred prison, five wanted the guillotine, four asked for the garotte, seven desired other methods, and eight would not commit themselves.

A USEFUL TELEPHONE.

A young lady stenographer employed in an office in Boston, remaining a little later than usual to finish some work after the rest of the people had gone for the day, was shocked to learn that she had inadvertently been locked in, and that the key of the door leading into the hallway could be inserted only from the outside.

Remembering, however, that there was a telephone in the janitor's office, she connected with them through the central station, asking the janitor to come up, who, when he arrived, very promptly unlocked the door, releasing the involuntary prisoner.

LOCATION OF DYNAMOS.

A recent instance of short-circuiting the armatures of two dynamos used in the electric illuminating plant of a large mill in this State was occasioned by an unlooked-for cause. On examining the destroyed armatures, evidences of attrition were noticeable, while it was certain that no portion of the field pieces could interfere with the motion of the armature.

These dynamos were driven from a shaft situated the other side of a partition of matched boards, with suitable apertures cut through for the passages of the belts. In the room the other side of this partition a number of emery wheels were used in grinding iron, and the metallic dust in the air was drawn by the currents of air into the dynamo room and there attracted upon the poles of the field magnets and held in a position sufficiently rigid to wear away the covering on the armatures and short-circuit them.

The lesson to be learned from this accident, which seriously interfered with the good name of the lighting system in that place, is not merely that the dynamos in mills should be placed out of reach of metallic dust, but also in the central stations, machinists' benches should not be placed too near the dynamos. In a large station, the organization of which places each department by itself, such a machinist bench would naturally be located by itself; but in smaller stations the whole plant, excepting the boilers, is too frequently huddled together in close quarters in the same room.

THE PRIZE GAS BILL.

Miss C. L. Long, residing in St. Louis, has received a gas bill that deserves special recognition. When our good-natured, contented looking gas friends read of this bill we fear they will be seized with envy, realizing, as they must, that they are as yet only novices in the business. Miss Long resides in the house alone; that is, she is the only one in the family, as it were, and she employs but one servant. She has no entertainments, receives very little company, and only occasionally lights the gas jet in the hall. It is turned off early in the evening, so that Miss Long practically uses only one burner, and that in her own room. This, of course, she does not keep at full head all night. Below will be found the amounts of the bills sent in by the gas company for gas consumed during the past four months:

October bill (September gas)	$3 15
November bill (October gas)	6 15
December bill (November gas)	6 00
January bill (December gas)	36 75

The bill which was sent October 1, while large enough for the amount of gas consumed in Miss Long's homestead, was not large enough to be the subject of any particular complaint. The November bill, which was twice as large almost, caused her to open her eyes a trifle, but did not prove really appalling, the more so as the bill rendered in December was reduced 15 cents. Still the lady was surprised, because she did not think that she had used twice as much gas in the months of October and November as that consumed in September.

When, however the bill for December's burning was turned in, the lady was horror-stricken at the amount. It exceeded her last bill some $30.75, and she had not burned a single foot of gas more than in the month preceding. Miss Long states that, fearing a clerical error had been made in the taking of the registration, she sent down to the gas office and had the bill examined. It was pronounced correct, the number of feet consumed being noted in pencil on one corner of the document. Miss Long said she had no particular objection to the company taking her surplus income over and above her living expenses, and making spending money out of her household. She would be willing to overlook little things like that; but when she found that it was necessary to mortgage her furniture and real estate to keep the gas going, she concluded that it was about time to stop. At the rate of increase, her bill for January's consumption would be $180, and her bill for February's consumption, $900. The prospect was too overwhelming, and she concluded she would try coal oil for a year or so. Ordinary gas-burners are supposed to burn five feet an hour. The company claims that they burn eight, and calculating on this basis Miss Long's bill represents a consumption which would require six burners, consuming eight feet an hour, and burning steadily, twenty-four hours to the day, for thirty days, instead of one burning on an average of three.

Although a complaint at the office did not seem to do Miss Long any particular good, a presentation of the facts by a reporter of the *Post-Dispatch* developed the fact that some hideous blunder had been made, which would be thoroughly and satisfactorily remedied immediately. The blunder had been made either by the meter man, who is supposed to be a model of accuracy, or by the clerks, who got a trifle mixed in their checkings.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

There is a town in Iowa where the electric light is a new thing, comparatively. The natives look aghast at it. At a nigger show a few nights since, one of the funny men spoke thus of the change of opinion regarding it. "Only a short time ago we all stood in awe of the mysterious force—now we make light of it," and as further illustrations of that old proverb, "Freedery breeds despise," it may be mentioned that a red and black painted Indian on their little variety stage lately experimented by sticking a knife blade into a lamp socket during the performance. When "Gassy" went to look for the cause of the darkness, Mr. Indian's knife blade was welded into the socket, a species of collateral evidence that the aboriginees perfectly comprehended welding by electric currents before any of the present claimants. Mr. Lo has already been retained as witness in an approaching suit.

The council on the 9th instant received a communication from Mayor Roche, announcing the placing of the river plant at the corner of Clinton and Washington streets, and stating that the same was now in operation. He also recommended that a second plant be placed at the Ashland avenue waterworks, and the river be lighted from North avenue on the North to Ashland avenue on the South.

Tuesday night, the 10th, at midnight, a large fire broke out at the east end of the Madison street bridge. The weather was intensely cold, and the wind was very fresh, and the water, which, by the way, was colder than hotel tea, did a good deal in the way of *frappé and glacé* decorations on walls and signs, and on the two electric lights which stand at the east end of the bridge. The icicles were long and crooked, and heavy, but the lights blazed as placidly and unconcernedly as a professional street beggar scoops the button the bad boy drops into his tin box. They acted as if they were put there by the fire department, under orders to aid the boys, and they did it nobly. The plant is a daisy, and there is very little if any current wasted in the way of escape. When the lights are all placed, two at either end of all bridges and street terminals, navigation will be as feasible after supper as before dinner.

Somebody once said that whenever there is a demand for something which did not before exist, some one goes and finds it. Just now, what is wanted in Chicago is somebody who will discover a method of forcing the gas concern to a sense of its awful condition and bring it to taw. What we hope is that the electric light is to do this—while it is possible that the natural gas deposit the wells throughout the city are developing may have an important bearing on the case. So far there has been but a limited amount developed at any one locality, with a pressure of but a few pounds. It may come and furnish us with a substitute for coal. Chicago is as dirty to-day as Pittsburgh was in her smoky, black days. One of her local literary comets gloated over the fact a short time ago, and said, among other things:

"Oh! where was the town
Of fame and renown
As smoky as Pittsburgh was then?
But now, with first-class
Good natural gas,
No town in the country's so clean!"

The Chicago Telephone Company, despite the obloquy which the daily papers have endeavored to throw on it, still lives, and wins on all suits for back rentals, and this does hurt the journalists woefully. The last case was against a quotation company; a case which the sensationalist of one of our dailies intimated would prove a petard to the telephone company.

Down in Elkhart the schoolmaster is abroad, and the Central Union Company has been "fired out," while a franchise has been granted the Cushman Company to put in an exchange. An attempt will be made on Monday night to pass an order to test the right of the Chicago company to the franchise under which it occupies the streets.

If hard luck overtakes the telephone people now, it may be attributed to the fact that some out-going officer has carried off the "left hind foot of a grave yard rabbit, killed in the dark of the moon," and torn down the horseshoe on the door.

The U. S. Telephone Company, of Chicago, was incorporated the other day with a capital of $300,000. Judging from outward appearances, here is another up-hill road for somebody.

The Chicago Electric Club held a reunion at the rooms, No. 122-4 Clark street, on the evening of the 7th inst. The entertainment was both original and unique, and was highly enjoyable. The committee on entertainments, consisting of Leonard, A. H. Brown, J. L. Barclay, Haskins and Shain, provided an excellent musical programme, in the midst of which came an intermission for refreshments. These too, in the form of a "sit round, lap party" lunch, were a success, most decidedly. For an hour or so there was a combination of social and physical enjoyment, after which the remainder of the musical programme was rendered.

The president, the venerable A. K. Stiles, then called the club to order, a vote of thanks was given to the musicians and the entertainment committee, and this was followed by volunteer duets between various members, and a hidden chestnut bell, which would persist in going off at all sorts of times, and no one seemed able to see exactly how.

There were some forty members of the club present, and the whole thing was voted a success in every particular. Some of the boys got to bed before one o'clock the same night.

A fire occurred here on the afternoon of the 7th inst., which entails upon the McIntosh Galvanic and Faradic Battery Company, and the Biele Electric Apparatus Company, severe losses. The value of the former company's machinery and stock being estimated at $50,000. Fortunately this is covered by insurance. Still there is the loss of time and business until the concern can get another start.

The same night the Brush station at St. Louis was damaged by fire some $10 000, and the circuits cut off by the occurrence, so that some 500 lights were rendered useless for the time being. The loss was covered by insurance, and the plant was running again in three days.

A peculiarity about that particular station lies in the fact that it runs more lights, by about four per cent., during daylight than it runs nights, and has a lot of motors on as well.

Chicago boasts of a racquet court lighted by electricity. F. W. Horne, of the Excelsior, furnished the plant.

The new laundry girl did it the other day. She wanted to go into a dark cellar, so she cut off one of the incandescent pendants, hung it on the bell wire in the cellar, and, just because she got no light, decided that the electric light is "a great *unsartinty*, so it is!"

In the table showing the distribution of fires at New Orleans are

Fires caused by electric wires.....3
Electric light wires.....4

making seven fires from electricity in some form.

There is but one way for New Orleans to surmount this difficulty, and that is in the line suggested in the above report. New Orleans cannot well bury her wires, and the Hart tower seems the next best thing.

Detroit, Michigan, is still in the agony of parturition on the underground question. The case of the "City *vs.* Somebody or other," is carried to the Circuit Court, and galloping Hessians are scouring the country for expert testimony, *pro* and *con*. In the meantime, on the evening of the 8th instant, the Light Infantry Drill Hall in Detroit was burned, and among the losses was the nearly complete destruction of the Knights Templar banner, which had been gathered preparatory to a grand reception. The Light Guard also lost a flag trophy.

The fire was caused by an electric current used for lighting the building. The fullest and clearest explanation of the whole affair is that given by a local reporter as follows: It is thought that while the men were at work putting up the decorations for the Knights Templar ball, they accidentally scraped the coating from a part of the electric light wire, and that the dry wall of the room took fire from the flying sparks when the current was turned on yesterday. This explanation of the origin of the fire is given by the officers of the company, who think it will make no difference in the payment of the insurance money. The proprietors of the building take the same view of the matter. Hereafter it will be well for electric light companies to strain out the flying sparks, and use nothing but pure current. The small amount of saving by neglecting to strain and skim out these flying sparks is not sufficient to warrant the assuming of the additional risk and responsibility.

CLicago, Jan. 14, 1888. C. C. H.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The regular meeting of the Merchants' Club was held at the Parker House on Thursday evening. The subject of the discussion of the evening was "Electricity." Prof. Chas. R. Cross, of the Institute of Technology, was the first speaker. After giving an account of the history and progress of the application of electricity, he came to the question, What is electricity? and pointed out that it was no more mysterious than any of the other unfamiliar facts of the universe. It is not ordinary matter, it is not energy, though, like matter, it cannot be destroyed. He then pointed out the analogies in the flow of electricity through a wire and the flow of water through a pipe. Mr. E. H. Johnson, President of the Edison Company, was the next speaker. He told of some of the later work of Mr. Edison, especially on the subject of obtaining electricity direct from coal, "so as to dispense with that crudest of all crude things in this age, steam." Mr. Johnson next quoted statistics showing the enormous electric investments of the country, and closed by describing recent experiments in electric heating, declaring the prospect so promising as to warrant the assertion that before long it would be possible to heat houses and offices by electricity. The time must soon come when a house or office would be lighted, heated, and ventilated and its elevator run by electricity. Dr. Blake gave some pleasing reminiscences of the early days of the telephone and was followed by Prof. Jaques, who stated that there are now a third of a million telephones in this country representing an investment of from $50,000,000 to $100,000,000, and explained that the difficulty of long distance telephone was that of cost, and not of a technical nature. For conversation between London and New York a wire as thick as a man's arm would be necessary, which, as a cable, with the proper insulation and covering would attain the size of a hogshead. Mr. Henry M. Whitney spoke on the subject of electricity as a motive power for street railways, saying what were needed, were proper storage batteries. Mr. Johnson responded to a request to speak again on this same subject, and held out the prospects of an early solution of the problem. Mr. James H. Benton was the last speaker. The club voted unanimously to offer the members' greetings to Mr. Edison, which offer was thankfully accepted by Mr. Johnson.

The Electric Club rooms were the scene on Saturday evening of one of those delightful entertainments which make the members wonder how they ever managed to get along without the club and its gatherings. Shortly after six about seventy members of the club seated themselves at the sumptuously spread tables, on invitation of Vice-President Denver. For an hour or more the clinking of knives, forks and spoons gave testimony to the energy which electrical men always exhibit in whatever they undertake. The warning that

> "There comes a reck'ning when the feast is o'er,
> A dreadful reck'ning, and men smile no more,"

was proven false in this case, for the next thing on the programme was a paper by Mr. Edward Blake, of the New England Sprague Motor agency, who read a paper on "The Electrical Transmission of Energy," which all enjoyed very much, and men did smile at the anecdotes related by Mr. Blake in this connection.

The speaker first gave Boston well-deserved praise for undertaking, three or four years ago, the running of wires from a central station for the distribution of power, and carrying it to a successful termination before it was considered elsewhere, while the latest English books still speak of it as something which may be accomplished at a future time, when the details are worked out. He next gave the principle of the motor as depending on a single postulate, which is, that a current or a wire carrying a current in a magnetic field tends to move, unless it is exactly parallel with the lines of force; this motion represents power, and is the principle of all motors as now built for practical use. Suppose a magnetic field here, this represents the current, said Mr. Blake, illustrating by a pencil, which will therefore tend to move, and is, in fact, the power. If we wish to add a dynamo and connecting wires, we have a complete system of electrical transmission power, including three parts: (1) the conversion of mechanical power into electrical power; (2) the conveying of the electricity; (3) the retransformation of the electrical into mechanical power. A motor resembles a dynamo in many respects. When in operation it is a true dynamo. A dynamo is a machine for generating and maintaining an electromotive force, not a current. The current is a secondary consideration, and its quantity may be found from the E.M.F. by Ohm's law. A discussion of the counter E.M.F. in a motor and its relation to the work done followed. Mr. Blake showed that the counter E.M.F. of a motor is not only a necessity and an advantage, but the action of the motor depends fundamentally upon it, and designers now try to increase rather than reduce it. Without it the motor would not work at all, and the more it cuts down the current, the more efficient the motor is.

The paper closed with a few words about the value of motors in practice.

At the conclusion of the paper an interesting discussion upon it and other electrical topics was kept up until there threatened to be an encroachment of the Sabbath, so loth to stop the flow of wit and wisdom were the attendant listeners. Among those to speak were ex-President Ridlon, Prof. Thomson, of the T.-H. Co., an honorary member of the club, and one whose clear statements are always listened to most attentively by the members; Mr. Rohrer, of the same company; Mr. Wilson, of the Boston Fire Alarm Telegraph; Col. Hewins, of the N. E. Weston; E. W. Rice, Jr., of the T.-H. Co.; Col. Ransom, of *Modern Light and Heat;* Mr. Campbell, and others. Songs by Messrs. Moriarty and Chapman and others followed later. Letters of regret were read by Mr. Davenport from several absent members, and a telegram was received from President Alexander, from Jacksonville, Florida.

The New England Weston electric car took a trip through Cambridge on Friday last. In the car were Col. Hewins and Mr. Alley, of the company; Mr. Avery, of Chicago, who is specially interested in the subject of electric street car propulsion; Mr. Troot, of Junction City, Kansas, a bank president, who, in common with many residents of that wide-awake State, always has an eye open for new inventions and scientific achievements. The trip was very satisfactory, the car mounting the steep Brighton curve at five miles an hour, notwithstanding the extremely slippery condition of the rails. The wheels on the front axle have the new polygonal surface, which is proving such a power saver on locomotives.

The Baxter Motor agency in this city has started in with a brisk business. One large motor went to Attleboro' last week for the printing business, and several of a smaller size are being installed in the watch factory at Waltham.

The new catalogue of the Boston Electric Gas Lighting Company is soon to appear. It will be a valuable book for reference for dealers in or consumers of electrical supplies.

The Lowell light station has recently put in a 300 H. P. Corliss engine for its Thomson-Houston arc light system. The capacity of the system is 600 arc lights. Friction clutch pulleys are in general use on the dynamos.

A 400 volt motor circuit has recently been started in Providence, using the T.-H. motors.

T. W. S.

Boston, Jan. 16, 1888.

Electric Club Notes.

A large number of visitors have already registered at the club house.

The board of managers meet every Thursday evening, and, as a rule, dine together at the club.

An electric clock, warranted to run one year without winding, has been placed in the billiard room of the club.

Through the courtesy of Mr. E. H. Johnson, the Burton electric heater will be in use at the club the evening of the opening.

The formal opening of the new club house, January 31st, promises to be a memorable event. Only members and a few officially invited guests will be admitted to the opening.

The engraved admission cards, sent to every member, are to be taken up at the door, the night of the opening, for the purpose of recording the attendance. Every member must bring his card with him, as that alone secures admittance.

Mr. Geo. A. Ladd, of San Francisco, with his family, has been a New York visitor for several weeks. Mr. Ladd was one of the pioneer telephone men of the Pacific coast, and his faith in the talking instrument has brought him excellent returns.

Several handsome paintings have been promised the club by the members. Among these is a very elegant one presented by Mr. T. N. Vail; also one by President Davis. Several have been received already, and the house committee is contemplating a "hanging bee."

The sleeping rooms of the Electric Club will be ready this week, and will be quite an accommodation to non-resident members. On the occasion of the opening, these rooms will be used for cloak and hat rooms, and on that night members cannot be accommodated with lodgings at the club.

A number of the non-resident members find the services of the club's stenographer, Mr. C. F. Johnson, quite a convenience while in the city. Fifth Avenue Hotel, one block from the club house, is where the stenographer is now located, but he will probably be given a room at the club later on. Some twenty new members were elected at the board meeting this week. This makes a total membership of 570.

The very elegant silver bowl, presented to the club by Capt. H. R Garden, has engraved on its front a Latin inscription or motto, appearing through a rift in the clouds, with flashes of lightning, producing the effect of an irregular electric chain. The inscription, *Jovis vi ipsius paratus*—"Equipped with the very might of Jove"—is intended, no doubt, to convey the meaning that as Jove, the king of all the gods, ruled the universe and held gods and men alike in subjection through the power of his right arm, which wielded the mighty thunderbolts, so will modern electrical science, representing the very might and power of Jove, control the world. As the object of the club is to gather together the elements which create this power, and, thus equipped, to form about its own hearthstone the true electric chain, the appropriateness of the donor's design in the chasing and engraving on the bowl is at once realized.

* * The Citizens Electric Light Company of Brooklyn is again running to the full capacity of its electrical apparatus, one hundred lights having been added in the last six weeks. This company now has twenty-five of the Thomson-Houston Electric Company's forty-five light machines which are run from two large engines. The lamps are all of 1,200 candle power and indicator cards taken with eleven hundred lights on a few nights since show that each lamp is being burned with an expenditure of gross energy of .652 of a horse power. This would seem to show that the enormous friction theory of the high speed engine builders was a myth.

The above, from the columns of our esteemed Boston contemporary, we trust is not the strongest argument the "long stroke" advocates have to use, for, from indicator cards before us, a Russell short stroke at Canton, Ohio, although underloaded, showed an expenditure of but .596 horse power per lamp of 1,200 candle power. In the Brooklyn station, upon this showing, could have been saved in the power now required for 1,000 lamps a total of 60 horse power.

*** Rochesterites are very happy over the prospects of a return to the telephone, after having been without it nearly a year.

*** There are now five long telephone lines extending out of Paris. These extend to Brussels, Rheims, Havre, Rouen and Lille.

*** The city of Burlington, Iowa, has resoluted all the telephone wires in the city underground, and ordered every pole removed. This time next year the same resolution will no doubt come up for adoption again.

*** The Hospital for Consumptives, at Ventnor, Isle of Wight, is to have telephone service between the wards, the doctor's office, etc. There was a time when a consumptive would not have dared to tackle the telephone, but the improvements of late years have remedied this.

*** The following telephone rates submitted by Col. D. B. Parker to the Rochester people have been substantially agreed to: Single lines—business, $64; professional, $54; residences, $45. Combination lines—business, $57; professional, $46; residences, $40; with a slight increase for underground work stated in the proposition of Colonel Parker.

*** Assemblyman Hadley and the clerk of the committee of the Legislature to investigate the alleged excessive rates by telephone companies of this State, are at Syracuse drawing up the committee's report, which will be submitted in thirty days. It is stated they will not report the finding of excessive rates, from testimony of subscribers, as there was little complaint from them, but they may report that, in some places, the rates are excessive as compared with the income of the companies. They also say that the evidence shows that the service of New York city is as good as can be expected under the circumstances.

*** The telephone, it is said, is not making much progress in Russia. And no wonder: fancy a man going to the 'phone and yelling:

"Hel-lo! Is that you, Dvisostkivchsmartvoiceski?"

"No. It's Zoilemschouskaffirnockenstiffsgowoff. Who's speaking."

"Sezlmochocwiertrjuaksmzyskischekeemoff. I want to know if Xliferomanskeffiskillmajuwchzvastowskskweibierski is still stopping with Dvisostkivchsmartvoiczski."

Such nomenclature over the telephone would tie the wire full of knots, and twist the annunciator all out of shape. Until the kinks are ironed out of Russian names the telephone will not be an overwhelming success in the land of the Czar.

*** Far more extensive use is made of the telephone on the railways of the continent than in this country. In Germany in particular an extensive series of trials have been carried out with this instrument on the State lines, and the Government has just issued a memorandum to the railway companies embodying the results of their experience. From this it appears that for local and branch lines, where the traffic is small, the telephone has in many cases entirely displaced the telegraph; and of late it has been considered safe to extend the system to busier lines where the telegraph was at one time considered indispensable. In these instances, however, we take it that the example of Germany is not at all likely to be followed in this country. But for intercommunication amongst the different departments of the larger stations the telephone is in almost universal use, and it is stated that no insuperable difficulty is experienced owing to the induction from other wires. All long-distance trains also carry telephone apparatus to be attached to the telegraph wire in the event of a breakdown *en route*. This is an example which it certainly might be useful to imitate. —*London Electrician.*

The Long-Distance Telephone Lines Completed to Albany.

The system of long-distance telephoning, for some time an accomplished fact between New York, Philadelphia and Boston, reached a satisfactory initial test in Albany last Sunday. For months past the American Telephone and Telegraph Company have been erecting poles to the number of 40 per mile along the river road on the east side between Albany and New York. On Saturday the final gap was closed, and Supt. Cull, having put up a temporary connection between the cables across the river at the foot of Columbia street and the commercial telephone office in Albany, communication was established and an initial call sent out at 4 P. M. Sunday. In the office at the Albany end of the wire were gathered General Manager Uline, Chief of Police Willard, Supt. Cull and representatives of the city press.

A direct connection was first obtained between Albany and Bedford, a distance of some 121 miles, and each person, from Manager Uline to the reporters, after a personal experiment was astonished at the facility with which messages were sent and received The varied tones of the voice were easily distinguishable, and the words came with more distinctiveness, owing to the metallic circuit, than they would over minor distances in the city where a grounded circuit is employed. While waiting to hear from New York, the Albany office was placed in communication with Bridgeport, Conn., an added distance of sixty-three miles, as the wires go, and the individuals of the party again, in ordinary tones of voice, sent their interrogatives concerning the weather, the health of the recipient of their queries, the distances between, and other impromptu subjects of conversation over to their sister city in the land of steady habits.

Then Boston, 350 miles away, was called up and readily responded. The superintendent of the Boston police department was called up by the central office at Boston, and Chief Willard and he held a short conversation relative to some of the Boston officers who are here for requisitions and prisoners. In talking with Boston a trifle less distinctiveness was noticed, but the words and sounds were as readily distinguished as though spoken in a telephone receiver across the street. General Manager J E Hudson, of the American Bell Telephone Company, was called up, and responded pleasantly from his residence in Malden, Mass. After the experiment with Boston, Danbury, Conn., was communicated with, and though over a hundred miles intervened, yet a remark addressed in a whisper, inaudible across a moderate sized apartment, was received, understood and answered in whisper by the operator at Danbury, the voice coming over the wire with the sibilant sound that characterizes the whispered communication of individuals near together. Another curious experiment was made while in communication with Danbury.

Supt. Cull was desirous of ascertaining what would be the effect of a connection, such as will have to be made when the line is in operation, between the metallic circuit of the long distance line and the grounded circuits of the local companies' wires. Accordingly he prepared to make the connection between the regular receiver of the new line and an old Edison receiver which hung in the office and was in connection through the switchboard of the central office with the city of Albany and vicinity. Before establishing the connection by a wire, he placed his moistened fingers on the points of the respective receivers of two instruments, and making his body a conductor, found himself able to talk through himself and receive a message by the same way from the operator at Danbury, Conn. Manager Uline also tried the method and found it quite easy to understand what was said, notwithstanding that the connection was made through the human body, with a grounded circuit.

The line will be open for general use this week, when Albanyites will find themselves able to converse with New York, Philadelphia or Boston and intermediate points in a most satisfactory manner. The company, having ten wires strung between Albany and New York, will be in a position to furnish brokers or other individuals desiring it, private wires, which will obviate all inconvenience and expense now entailed by the necessity of employing a telegraph operator to take and send messages. The charge will be in the neighborhood of $1. As this places no restriction on the number of words sent, Albanians, at this very moderate expense, will be enabled to converse with their friends, 150 miles away, engage a box at Wallack's, or the Casino, or Madison Square, or order goods from the great commercial port of our country without leaving their residences.

Early in the evening a connection was established for a short time with New York, and the fact of the successful working of the line demonstrated.

During the coming week the work of continuing the line to Troy will be commenced, and it is generally expected that the company will push forward the construction of a line between Albany and Buffalo.

The Telephone Situation in Chicago.

To the Editor of Electrical Review:

One of the Chicago journals had taken several whacks at the matter at various intervals, but didn't get down to systematic work until it was learned that the Supreme Court was about ready to speak.

Then the rainy season, so to call it, came, and the muck-rake has been quite busy since. A few days ago, having exhausted its original thoughts and abilities, an edition of five hundred circulars was issued by a daily, asking subscribers:

1. Is your telephone service satisfactory?
2. Is the telephone a necessary adjunct to the successful pursuit of your business?
3. Do you consider the cost of service too high?

Out of this lot of circulars, 272 answers were received. The service was satisfactory to 43, while 51 said that it was occasionally bad, and the remaining 178 rated the service as frequently imperfect, bad, very bad, execrable! Of course, nearly everybody said the price was too high: that's human nature. One customer's principal cause for complaint seems to be based on the fact that one of the girlies told him to go "soak his head."

Then the general manager was interviewed, and said:

"What we make is nobody's business but our own. We might charge $500 an instrument if we pleased. Mr. John R. Walsh suggested that we raise the price to $500 and reduce the number of 'phones to 1,000. We could do that and give an absolutely satisfactory service, and make a great deal more money. But we prefer to extend our business and accommodate the public. Why shouldn't we make money? Would the *Tribune* dare go into Marshall Field's and tell him he's making too much money and will have to cut down his prices? Of course not. Then why dictate to us? We own our plant, we pay for our work, and we clear a profit. How much or how little is nobody's business but our own."

And the newspaper says:

That settles that question. "The public be——!" We will tax the business all it will bear and you can go to thunder!

Then another journal took up the trail, (the first had no right to the scoop, of course!) and went for Sunny. B. E. threw up his hands, and shouted, "Don't shoot the organist; he is doing his very best," and then gave the interviewer some figures, showing that the public really knows nothing about the matter the newspapers are stirring up. The company is to-day arranging for a multiple switchboard, which will cost $110,000, which he thinks will wear out in about five years. Something between $300,000 and $400,000 has been spent in underground cables, which have not proved perfectly satisfactory, but will have to be replaced for a metallic circuit system in the near future, and a great many other expenditures are knocking for recognition at the treasurer's door.

The journal referred to, after finishing the interview with Mr. Sunny, says:

"Sunny is not solely responsible for the condition of affairs. He is superintendent, but up to a short time ago there was over and above him one C. Norman Fay, who held the office of second vice president and general manager. Mr. Fay resigned some few weeks ago, and was at once elected to the head of the 'Gas Trust' at the princely salary of $20,000 per annum. One of his principal recommendations was that he was strong in the city council and had been able to work the aldermen in the most adept manner for anything he wanted, but perhaps the recommendation would have been better were it stated truthfully that he had so skillfully squeezed the public for one corporation that he was likely to prove an expert in squeezing it for another."

One thing is certain—the service here is such, that either the city missionaries will have to fly round or the decreased demand for Chicago halos and robes will create a dearth of employment in the "furnishing goods department," up there, unless things mend soon.

The telephone indignation effusions have filled the papers, and the business has been well ventilated, *pro* and *con*. To keep up the sensation, somebody writes over the signature of "One of the Girls," and calls the telephone business a system of "white slavery."

Mr. Fay, for the company, appeared in one of the dailies as defendant, and then a battalion of literary shot guns took a crack at him for his temerity.

Mr. Chas. H. Wilson, superintendent, for some time past a resident of Columbus, Ohio, has returned to Chicago, to reside in the future. Mrs. Wilson—no, Charley is a bachelor, so far—and Miss Gussie, have also returned with him to Chicago. The many friends of the family will gladly welcome the ladies as well as Mr. W., and he will, as soon as thoroughly recovered from his recent illness, take hold of the superintendency of the Chicago Company with a will. It is a pleasure to his hosts of friends to see him around his accustomed haunts once more, and none but the kindliest wishes for his health and success are heard on every hand.

Several attempts have been made to fix a per annum tax or license on telephone companies doing business in the city. These, so far, have failed. The last attempt, which is being worked just now, is that the company has no franchise. The Bell Company, of Boston, held the original franchise. The Bell and the A. D. T. united and formed the present company, and the Bell of Boston gave up its franchise—which that corporation, it is said, had no right to do. But the other side says "the Bell Company to-day owns over one-half the stock of this company," and rather suggests the similarity between this and another celebrated case, in which one of the parties asked, "In the resurrection, therefore, when they shall rise, whose wife shall she be of them? for the seven had her to wife."

Chicago, Jan. 6.

The St. Louis Anticipation.

The time is not far distant when we will have wagons driving around with casks and jars of stored electricity, just as we have milk and bread wagons at present. The house of the future will be constructed with the view of containing electric apparatus for lighting, power and cooking purposes. The arrangements will be of such a character that houses can be supplied with enough stored electricity to last twenty-four hours. All that the man with the cask will have to do will be to drive up to the back door, detach the cask left the day before, replace it with a new one, and then go to the next house and do likewise. This very thing will be soon taking place in St. Louis.—*Globe-Democrat.*

.... All the police and fire alarm underground wires will have been laid by the middle of this week in the city of Detroit. When the work is completed all the city wires west of Hastings street, south of Adams avenue, and east of Third street, will be underground. The system is eighteen miles in length—this estimate is cable measurement. Each cable contains from six to forty wires. Last spring the common council appropriated $35,000 for this purpose. The expense of placing the wires underground has exceeded the appropriation by over $10,000. The question is, How are the contractors to be paid?

OUR KANSAS CITY LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The Seward (Neb.) Electric Light and Power Company has been incorporated. Capital stock, $10,000.

The Nebraska Telephone Company has about completed the line between Beatrice and Fairbury. The line takes in the towns of Ellis, Harbine and Jansen.

Herrington, Kas., was lighted by electricity Christmas eve, and claims to be the youngest city in the world to be lighted by electricity.

Anthony, Kas., has granted an electric light franchise to the Brush Electric Light Company. It is identical with the expired franchise granted the Archer Company, excepting the price for arc lights. The rental for these is fixed at $10 a month for each light for any number up to ten; $9 when ten to fifteen are used; $8.33⅓ where more than fifteen.

The Kingman Electric Light Company is in operation. The engine has a capacity for 100 arc lights.

Dodge City, Kas., has granted a franchise to a number of its citizens for a telephone exchange. The work of putting up the poles will begin at an early day. About 100 instruments will be put in.

The Des Moines, Ia., street railroad company, the Narrow Gauge, has begun suit against the Broad Gauge, or Electric Street Railway, for $40,000 damages because of the operation of the latter during the past year and a half.

An experiment is being conducted on the Atchison, Topeka and Santa Fe train between Atchison and Topeka, of the DeMeir electric signal. The locomotive bell is rung by pulling a cord in the coaches, which presses two pieces of brass together at the ends of the coaches, and sends a current of electricity to the locomotive. The inventor is John M. DeMeir, of Las Cruces, N. M.

A guest at the Monroe House, Jefferson City, Mo., walked behind the counter in the office last Friday morning and endeavored to force a nickel into the telephone box. He explained his action when interrupted by the clerk, by saying that he thought it was "one of them darned new-fangled contraptions that would give you what you wanted by chuckin' a nickel into 'em."

A new engine has been placed in position in the Empire Electric Light works. It is of 75 horse power and was manufactured by the Buckeye engine company, of Salem, Ohio. The machinery of the plant is being rapidly placed in position, and will soon be ready for operation.

Osage City, Kas., is wildly clamoring for an electric light system. Unless a company soon goes in there the city will go into the business itself.

The present electric light plant in Ouray, Cal., is taxed to its fullest capacity, and a new plant is being established.

The linemen of the Central Branch railroad to Kansas are stringing three additional telegraph wires along the Lenora branch leading to the Southwest. Many think this indicates an extension to Denver.

The first ward in Topeka is separated from the rest of the city by a river. While the main part of the city has been enjoying the benefit of electric light for some time, the first ward has waited in vain for the incandescent light company to extend its wires across the river and dispel the shadows there accumulated. The citizens of this ward have accordingly determined to organize a company and put in a plant of their own, and have appointed committees to canvass the ward on the question.

Mr. Steele, the agent of the Burlington (Kas.) Electric Light Company, has secured subscriptions for 100 incandescent and 12 arc lights. The engine, machinery, wires, poles and all material for the plant have been ordered, and it is expected that the plant will be in operation during February.

The warlike feeling between Harper and Anthony, in Harper county, Kas., over the county seat question, has caused the two cities to cut the telegraph and telephone wires communicating between them, and now each is accusing the other of committing the deeds.

The Harrington, Kas., electric light plant now needs only its big boilers to be complete, and they are on the way.

An agreement has been signed by the Memphis (Tenn.) Telephone Company, through its president, O. F. Noel, to the effect that all telephone wires in the heart of the city shall be put in cables.

Washington, Mo., is considering the question of establishing electric light works.

The Kansas City Electric Time Company has at last established the circuit for operating its system. The central station is in Cady & Olmstead's jewelry store. The clocks require not the slightest attention or winding of any kind. A message is received by direct wire from the observatory at Glascow, Mo., every day, the signals denoting absolutely correct time. At the central station is a fine regulator which is very accurate, and which is compared daily with observatory time as shown by the signals.

The Independence (Mo.) Electric Light Company has received a Westinghouse engine of sixty horse power. Its weight is three tons. The boilers will arrive next week. Four hundred and fifty incandescent lamps have been received and will be used in private residences. Two hundred poles are being distributed over the city for the purpose of carrying the wire for these incandescent lamps.

O. O. Steele, the gentleman to whom was granted an electric light franchise by Burlington, Kansas, is now busily engaged in getting his plant into operating condition. He has ordered all the necessary material, except that required for motive power. He has examined the engine and boilers formerly used in the Burlington mills, and may decide to purchase them. He feels certain of securing patrons for about 100 incandescent lights and 10 arc lights by the time he will be ready to begin operations, which will be Feb. 1.

A break in machinery has compelled the electric light patrons of Liberty, Mo., to take recourse to candles and kerosene for about a week.

Fort Scott, Kansas, is at present undergoing a contest with the Fort Scott Gas Company, or is suffering from an attack of disgust with poor gas. Several months ago the city contracted with the company for the illumination of the city, it being understood that the gas supplied would be coal gas. Almost immediately the gas company purchased a patent machine for manufacturing water gas, which has, so far, proven a failure, and the city is in a condition but little better than darkness. At a late meeting of the city council a franchise was granted G. P. Knapp for a fuel illumination and electric light company, which will soon begin the erection of a plant. Natural gas is also being used here, but a third company has been formed to bore for that product, and "natural gas experts" say that deep boring will produce a Findlay (Ohio) gas well.

In conversation with your correspondent a prominent attorney said: "The people of this city are quietly lying by, sleeping on their rights, so to speak, while a vested or prescriptive right is growing up, which will, if not watched and checked, ultimately prove oppressive to the last degree. Look overhead and see how the electric wires are stretched over and attached to nearly every house in the city. Some day some innocent looking little bill will be slipped through the Legislature shortening the time when title by prescription accrues, and half the people will wake up to find their property practically beyond their own control. Every house owner who has permitted the wire companies to roost on top of his premises, and all, before permitting similar use in the future, should compel the companies to sign very clear papers acknowledging a tenancy at will, otherwise there will be the very deuce to play before long. In fact, even without additional legislation, the time is rapidly approaching when the right of way over some of the older houses down town will have been acquired by the user."

G. M.

Kansas City, Mo., Jan. 7, 1888.

OUR OMAHA LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

Omaha is now discussing the building of a million dollar hotel. Among the first considerations, of course, was the part electricity would play in it. It was decided at the very first, that the hotel would be lighted with electricity, both the arc and incandescent lights to be used. Electric annunciators, fire alarms, call bells, elevators operated by electricity, and every other practical use of electricity that could be made it was decided to make.

As time progresses, and the arrangements for the electric lighting of Council Bluffs, Iowa, just across the river from Omaha, become perfected, it is more and more evident that the adoption of this system by that city was the part of wisdom. The company has labored under many disadvantages and suffered from many accidents in the construction of its works, but it has at last succeeded in producing a light that proves eminently satisfactory.

Des Moines, Iowa, is agitated at present by a street car fight. The broad gauge and the narrow gauge are struggling for a charter. The broad gauge company proposes to operate its line by means of an electric motor. A special session of the council was held, at which an ordinance was introduced granting a charter to the broad gauge company, and read a second time, after which the council adjourned.

Mr. C. K. Mead, manager of the Des Moines telephone exchange, was out hunting last week, and his left hand was badly wounded. His gun was accidentally discharged, the load carrying away the third and fourth fingers of his hand.

The electric company of Hastings, Neb., which has been laboring under the disadvantage of starting up before it was ready, and which, in consequence, has been more or less out of order ever since, has completed this week the work of putting in the last needed boiler. It now has two large boilers and four dynamos in working order, and is prepared to run all its circuits, both arc and incandescent, with full power, and without intermission.

The Electric Light Company of Fremont, Neb., is extending its lines. The patronage of this sterling little company is being rapidly increased, and it will soon be compelled to put in another dynamo.

The following wail comes from Lincoln, Neb., regarding telegraph service: Lincoln is deplorably behind in all matters connected with the transmission of news. By the Western Union, every dispatch sent east of the Missouri river has to be relayed two or three times. Some time since, a newspaper correspondent here asked the manager of the Western Union office what caused the delay in a dispatch to Hastings, Neb. He was informed that the trouble was with the office in Kansas City. Hastings, it must be remembered, is but 97 miles from Lincoln. For the dispatch to be delayed in Kansas City, it had to travel the 182 miles to Kansas City from Lincoln, and then, if it finally reached Hastings, it had to travel 250 miles more. There seems to be room for radical reform in this matter. E. G.

Omaha, Neb., Dec. 23, 1887.

The Gamewell Fire Alarm Telegraph Company, through its Western offices, has done well in the past season. A glance at the new list of captured towns shows how generally the world is awakening to the necessity of having some reliable means of fire prevention. Mr. Webb Chandlee, of Richmond, Indiana, has increased the list by bringing the following towns into the fold: Birmingham, Ala.; Newark, Steubenville and Greenville, Ohio; Vincennes, Michigan City, Goshen and West Indianapolis, Indiana; Frankfort, Ky. Through his agency also, both McKeesport, Pa., and Ft. Wayne, Ind., have adopted the Police Telephone and Signal Company's system, which originated in Chicago.

TELEGRAPHIC

.... An important principle respecting the liability of telegraph companies for failure to deliver dispatches has been announced in Arizona. The firm of Hudson & Co. delivered a message to the Western Union Telegraph Company at Tucson, to be sent to a correspondent at Tombstone. The telegram was received by the operator at Tombstone at 9.15 P. M, on May 9, but was not delivered till the morning of the 10th, between 9.15 and 9.30, notwithstanding that the telegraph office was less than two blocks from the destination of the message. Considerable damage was caused by the delay, and in a suit to recover the same it has been decided that the company must pay.

.... The removal of the telegraph instruments by the Western Union Company from the floor of the Corn and Flour Exchange, Baltimore, has caused considerable inconvenience to members. Instead of being received and sent from 'change, dispatches had to be carried to the main office of the company and delivered on the floor by an array of messenger boys. The inconvenience experienced, although business had not fully recovered from the New Year's stagnation, led many of the members to declare that to do without a telegraph office on the floor would be impossible.

.... Just after the first telegraph office was opened in Washington, occupying a little room over the city post-office, a member of the cabinet entered one day in a flurry, and, handing in a bulky document, directed the operator to "telegraph it over to Baltimore right away." It was closed with a great seal, which the operator proceeded to break, to the astonishment of the statesman, who, objecting, declared that the paper contained a State secret, and of course, must not be exposed to any unofficial eye.

"But I can't telegraph it without I read it," insisted the operator.

"Well, then, you can't send it at all," and the high official left, excited and threatening. He believed he was being trifled with. His idea was that the telegraph was a sort of aerial express for the whisking of packages through the air—probably by hitching them on to the wire by a good tough piece of twine.

.... In Indiana, in the autumn after Congress had made its thirty-thousand-dollar appropriation to Morse for his experimental line, the congressman of that district was up for re-election. Poor deluded man, he had unfortunately voted for that appropriation. He had been for years the political pride of the district. The people out there would give him anything he'd take if they had the giving of it. Of course, he didn't doubt that he would be re-elected, as if by acclamation; but before election day he saw things differently. A young man whom nobody had ever heard much of before got an opposition nomination, and went stumping all over the district, and before long, the fight became very warm. "I have not one word to say against my opponent," so the young man always began his speech. "He's a gentleman; his character cannot be impeached; he is honest, reasonable, well informed, a good neighbor, and a real nice man. But, gentlemen, while he was in Congress, he voted your money away upon clap-trap things like this," and the nominee, producing a congressional document, proceeded to read the text of the bill which appropriated the $30,000 for Morse's experiments. "Thirty thousand dollars!" he would exclaim. "Thirty thousand of your hard-earned dollars, gentlemen! For what? Why, to settle—listen to the bill, gentlemen, to settle the practicability of sending messages by electricity over wires stretched long distances What do you think of it, gentlemen? Yes, my opponent is a good man; he means well; but really, has his residence in Washington helped him any? If he had staid here at home with us, would he ever have voted our money away for such a crazy purpose? Still, if you think it right to vote for a man who can be fooled in this way, gentlemen, all right, but—"

The old man was defeated.

ELECTRICAL AND SCIENTIFIC

* * At the present time there are at least 15,000 arc lamps and 170,000 incandescent lamps in operation in Germany, which receive their light from 4 000 dynamos.

* * The Chenoweth Conduit Company, Rahway, has been incorporated. Capital stock, $200,000. John Weaver and others, incorporators. This company expects to secure the patents of A. C. Chenoweth, which comprise a new idea in conduit work.

* * An effort is being made to introduce the American system of electric lighting in Cape Vincent. Representatives of that company are now engaged in awakening public sentiment in favor of the scheme, and it is hoped they will succeed. The Cape has some of the finest stores and business blocks in northern New York, and needs nothing more than electric lighting.

* * A New York man has invented a device to save horses in case of fire. It can be worked either by electricity or by hand. At a certain temperature a bell will ring, and the moment the bell shall ring the doors will fly open, the horses will be unhitched, and two small streams of water will strike each horse in the face. To escape the water the horses will back out of the stalls, and, once out of them, they will have an opportunity of seeing a way of escape through the open doors.

* * The Rothschilds are said to have secured the Bernardo electric welding process for France, Belgium, Spain, Italy, and Austria. The invention referred to relates to a method of working metals by the direct application of an electric current, and more especially of forming alloys by the same means. The results obtained are stated to be most remarkable, it being an easy thing to intimately commingle all manners of metals, even those least fusible, without the admixture of any substance save solder, and to effect this not only between homogeneous, but also heterogeneous metals, alloying, *e. g.* copper with both wrought and cast-iron, nickel with iron, lead with iron, aluminum with platinum, etc. Among professional metallurgists we are told that much importance is attached to this invention, and the preliminary trials that have taken place at St. Petersburg and at Creil, near Paris, having turned out most successful, several French and Russian metallurgists are stated to have applied for licenses to work the system on a commercial scale.

* * The extended Electro-Metal Extracting, Refining and Plating Company, Limited, has been organized in London, England, with a capital of £150,000 in £1 shares, of which 40,000 will be issued as fully paid, in part payment for the existing patents, plant, machinery and lease of works. The company is formed to acquire and work the business and patented electro processes for the United Kingdom of the Electro-Metal Extracting, Refining and Plating Company, Limited, for refining, separating and recovering tin, copper and other metals and alloys from scrap and old metals, dross, slags and mining tailings, and for electro-galvanizing iron goods. The processes have, it is stated, been thoroughly tested and proved by actual operations during the past twelve months at the works which have been established in Hutchings street, Millwall, while the results are such as to show beyond doubt their great value. The company proposes to erect and carry on four such works, in addition to the London works, and it is intended to erect them in Swansea, Birmingham, Liverpool, and Glasgow, the centers of the manufacturing districts, where the materials for the company's operations can be obtained and the products disposed of to advantage.

OUR CINCINNATI LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

An incandescent lamp factory is to be equipped and put in operation at once in this city by the Haus Electric Light Company. Meeting Mr. Haus on the street yesterday, he introduced Mr. Opperman, who is to be superintendent of the lamp works. Mr. Opperman was called from London, England, to fill this important position.

The Queen City Electric Company is about to be incorporated and organized. This company has now in successful operation a number of isolations in large factories. They will occupy, when completed, the new Murdoch building on Longworth street. The basement will be utilized for a central station plant of capacity for 3,000 incandescent lamps, 75 horse power current for motors. The floors above will be used for workshops and office. Mr. Foote manipulates the desk, at the present time, in Reid's building, while Mr. Davis does the wire pulling around the electric field, and he does it handsomely.

We have a little monarch in this city whose name is Andy Hickenlooper. His time is principally occupied in presiding over the affairs of the gas company. He may sometimes be seen "on 'change" and at the council chamber and in the neighborhood of newspaper offices and other innocent places. For reasons best known to himself he shows an antipathy for the electric light, and does all he can to impede its progress, not being satisfied with the possession of the city lighting contract *sine die*. Notwithstanding his rulership, we are brightening up our city beautifully, and the prospects are that, in the near future, the Queen City will shine with an incomparable electrical glow.

Our young electricians cannot complain for lack of home patronage, for most of the plants installed here are home-made, and give fair promise.

The prime coming event is the Centennial of Ohio, which is to be celebrated here by an immense exposition, comparable only to the Philadelphia Centennial.

An annex building, covering Washington Park, is nearly completed. The annex, covering the canal and its two roadways, two squares long, is well under way. The Park building will be connected with Music Hall by a bridge over Elm street.

A large space is allotted, in the Park annex, for an electric light installation, of capacity for 600 arc lights and 4,000 incandescent lamps. There will also, in addition to this, be a space allotted for a large display of electric machines and apparatus.

It is booked to open on July 4th and to continue during three months.

A lesson on gas was taught to the commissioners of last exposition, which they will profit by this time. Gas was used for illumination because the gas company donated it, free of charge. As a consequence, the incubators would not work, because the hens that were provided to lay the eggs never got off the roost. KIMO.

Cincinnati, January 14.

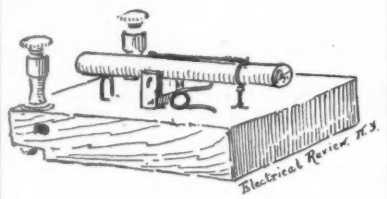
—— Experiments have been made at the torpedo station at Newport, to ascertain the best way of illuminating the body of the sea below and in the immediate neighborhood of a boat, and a novel use for incandescent lamps has been thereby developed. It was found that a very effective light could be obtained by submerging incandescent lamps in the sea. Each lamp is of 100 candle power, provided with a water-tight fitting and connections, and mounted upon a pole 20 feet long, which is lowered vertically from the side of the vessel. By this means the body of the water is illuminated to a radius of 150 feet, though the light is not visible from a distance.

—— The Great Barrington (Mass.) Electric Light Company has been incorporated, with a capital of $16,000; D. Ward Lothrop, president; Frank H. Wright, treasurer.

A Boy's Ingenuity.

George is between 11 and 12 years of age, and has always manifested an inclination to both mechanical and electrical knowledge. He has a lathe, and turns out rolling pins, bangles, sticks with loose rings on them, and all that sort of things, in quantities to suit demand. He reads the REVIEW regularly.

Recently George felt that necessity required he should make a magnetic motor. It was all right, in every respect, save that it lacked power to overcome friction. The amount of battery was insufficient. Recently he made a vibrating bell, which is a curiosity, but works all right. His pride seems to lie in the direction of accomplishing everything without help or expense, out of the commonest and plainest material, and his facility in utilizing every-day things is remarkable, and shows what a boy can do without help, if he tries.



A BOY'S HAND-MADE TELEGRAPH KEY

He constructed a telegraph line, but had no key. He made one.

The base is a wooden block. At the two corners are two binding posts. The axle rest is made of lead, solder, tin, and possibly some antimony and zinc. The metal is an alloy, part of which came from oyster cans, old tin, bits of lead picked up almost anywhere. The axle-rest is made of beaten metal, cut to proper shape by a chisel and mallet—and George made the mallet. The key works in this rest, on a hair-pin, which goes through the key. The back stop is a two-pointed wire tack, and the anvil is a pressed, flat-headed nail. The key lever is a round stick. Contact is made from one binding post to the anvil under the block, and from the other post to key, up through the block to the axle rest, and thence along the key to a point over the anvil, where the wire is twisted and fastened to make a contact when the key is depressed. The spring is made from a hair-pin, and here is a sketch of the whole, which is given to encourage young lads who lack in that faculty which George has shown in surmounting very considerable boy difficulties. What boy can beat it?

Another Electric Meter.

Herr Zacharias has introduced an apparatus for automatically recording the pressure kept in the mains of an electrical supply system, which is in use in Berlin, according to the correspondent of *Industries* in the German metropolis, with very satisfactory results. The apparatus, which has been made by Messrs. Siemens and Halske, consists of an ordinary clock, with a pendulum making 80 beats per minute, and which, every 45 seconds, closes an electric contact, throwing an electro-magnet into circuit. The armature of this magnet is balanced by a spring, so as to occupy a definite position when the standard pressure of 120 volts is in the mains. If the pressure is either greater or smaller, the armature occupies positions to either side of the normal. The armature is provided with a pin, in front of which a cylinder, carrying a paper strip, slowly revolves, a line marking the position which corresponds to 120 volts. At the moment of making contact with the electro-magnet the current is also sent through another electro-magnet, which presses the cylinder for an instant against the pin on the armature of the first magnet, and thus a hole is pricked, and the position of it on either side of the 120-volt line shows the variation of pressure existing at the moment. After a few seconds the current is again interrupted, and the same cycle of operations is repeated every 45 seconds; thus a series of marks is obtained on the paper strip, forming a record. Herr Zacharias also tried to obtain an absolutely constant record, by keeping the paper strip always up to the pin; but this not proving successful, the plan of recording at short intervals was adopted.

Electrical Personals.

Mr. J. M. Jackson, treasurer of the Western Electric Company, Chicago, was a New York and Boston visitor last week.

Col. Fred A. Mason, one of the best informed brass manufacturers in the United States, was a New York visitor last week.

H. M. Linnell, the active business manager of the Hartford Dynamic Company, is often called to New York on electric and power business. He was registered at the Electric Club last week.

Eugene F. Phillips, the Providence wire manufacturer, whose reputation for fine wire is only equaled by his good looks, spent 18 hours in New York last week. His extensive factory is running under full headway.

H. A. Cleverly and Geo. F. Porter turned their backs on Philadelphia for two whole days last week, and transacted more business in New York in those two days than could have been stirred up in Philadelphia in a week's time.

Arthur G. Newton and M. E. Baird, of the Eddy Electric Company, came over from Hartford last week. Mr. Baird was formerly associated with the Boston office of Holmes, Booth & Haydens, but is now a full-fledged motor man, and sure to win a large share of the electric motor business, with the "Eddy Motor" as his battle cry.

Mr. Paul W. Bossart, superintendent of the Inter-State Electric Company, of Kansas City, Mo., has installed an accumulator electric lighting system in Burrton, Harvey county, Kansas, which is giving excellent satisfaction. Negotiations are pending, also, for the installation of the storage battery system in a number of Kansas towns.

Mr. E. B. Chandler, General Western agent of the Gamewell Company, assisted by special agent Chas. A. Rolfe, contributes the following additions to the Gamewell list: Dallas, Tex.; Duluth and Winona, Minn.; Janesville, and Hurley, Wis.; Dubuque and Sioux City, Iowa: Adrian, Ludington and Battle Creek, Mich.; and East St. Louis, Illinois.

Mr. James Brown, superintendent of the Direct United States Cable Co., Limited, 40 Broadway, has issued an interesting cable card for hanging in offices, on which appears, in addition to a calendar, dates of important electrical occurrences and a map of the cable lines of the company. Much valuable data, of interest to electrical people is condensed in this record, which is most conveniently arranged.

Electrical Observations.

When General Greely became chief signal officer he found that seven experimental stations established for the purpose of ascertaining the laws governing atmospheric electricity, and learning the effects of this agency upon variations of the barometer, had been in operation about a year. But the observations that were then making were not conducted upon any well-digested plan, and the data they furnished were not comparable for the purpose of deducing any general laws. Gen. Greely therefore suspended their operation. Dr. T. C. Mendenhall, formerly connected with the Signal Office, now of the Rose Polytechnic School, and who had given much time to the study of atmospheric electricity, subsequently consented to take charge of this work until the first of July next. Stations have been established under his direction at Boston, New Haven, Ithaca, N. Y., Washington and Terre Haute, Ind. Each has been placed in charge of an enlisted man of the signal service, those having been selected who are experts in making electrical observations, several of them being college graduates.

The stations have been located by Dr. Mendenhall in localities where the known electrical conditions of the atmosphere are most favorable, and the observations are made in accordance with a uniform system. Dr. Mendenhall's report embodying such conclusions as he may draw from the observations, will probably accompany General Greely's next annual report, and it is expected to be of considerable scientific importance.

Electric Light in the Kansas Penitentiary.

The following is the electric light statement of the Kansas State Penitentiary for the year ending December 31, 1887.

Location of Lamps.	Recapitulation. Hours Run.	Lamps Burning Average	Lamp Hours.	Lamps Broken	Average Lamp Hours.
Warden's Building	2736	67¼	161365	106	1522
Deputy Warden's House	2736	9½	22816	11	2074
North Cell House	1107 50	186	206057	92	2240
South " "	1107 50	186	206057	90	2289
Officers Dining Room	2736	23	55265	17	3251
Convicts' " "	1484 05	49	72886	14	5206
Hospital	1107 50	8	8862	4	2215
Female Prison	1107 50	19	21049	9	2338
Engine Room	2736	14	38790	6	5632
Yard	2736	21⅛	51636	63	819
Coal Shaft	94	22	2068	16	129
Total			841841	428	1967

Expenses.	
Engineer and Fireman	$902 50
Fuel—506 Tons of Coal @ $1.75	885 50
Oils	78 24
Repairs	64 12
Broken Lamps, 468 @ 85	397 80
Total	$2328 16

Comparison with Gas.

841,841 lamp hours this year rating each at 4ft. per hour, it is equivalent to 3,367,364 ft. of gas. Costing $2328.16 or 69c. per thousand.

40 lamps broken carelessly, counted in expenses, not in lamp hours.

Mr. Dan Storrs is the Chief Engineer of the electric light plant, and manages it in a manner satisfactory to the officials of the State.

Theater Lighting in Chicago.

A very excellent piece of work is the electric light installation at the new Haymarket Theater in Chicago. The manager, Mr. Will. S. Davis—who, by the way, is life partner of Mrs. Jessie Bartlett Davis, the celebrated vocalist and writer—has been not a little annoyed by the willful repetition of the statement that the Haymarket is in some way or other a sort of monument, or a reminder, of the anarchist troubles. The name was selected solely as a continuance, a descendant of the old "Haymarket" of London; just exactly as young mothers prefer to name their little ones after prosperous uncles or aunts, rather than call them after the black sheep of the family, or seek to continue the Washingtons and Grants, rather than the Cornwallises and the other failures in politics, religion, or war. The theater is a gem of construction and arrangement, while at the same time it will comfortably seat more people than any similar structure in the city. The seats number 2,800 and standing room will swell the capacity to 3,000. The electrical work and results are what more especially concerned the Reviewist, when shown the plant by Prof. Badt, who has had charge, from the commencement, of the entire work. The steam plant consists of two of A. L. Ide's latest engines, an 8 × 12 called the "Ideal," (Ide, A. L.—see?) and a 14 × 20. The dynamos are three in number, 2 of 600, and one of 200 incandescent capacity, of the United States Company's construction and system.

The arrangement of lights, due to the ingenuity of Prof. Badt, is at once striking and pleasing. While there is a great abundance of light, there is not the least unpleasantness from the glare.

A single row of lights adorns the outer curve of the proscenium arch, and somehow suggests, when the curtain is down, a diamond-studded bonnet, whose shy and pretty wearer you hope to have a glimpse of, when "clear the stage" is succeeded by the tinkle of the bell that orders the veil removed. Around the boxes the groups of lamps are between the lines of sight of the audience, either above or below them, while shedding a beautifully soft and pleasant light throughout the house; and when these are turned down to a dull red during the performance, it is not difficult to see from the stage, a series of tropical balconies, along the front of which the trumpet vine is displaying its wealth of orange blossoms.

The stage switches are noiseless, without spark, convenient to handle, and requiring but little of the cramped room which the prompter ever has accorded to him on his side of the stage. These, too, are Prof. Badt's, and are a credit to him. The Professor has said some pretty hard things of the plumbers, gas men, lathers and plasterers, but the management has sided with him in his struggles, and he has "loved" the job through, and to-day it stands a model the U. S. Co., and especially the western agency, at the head of which is Mr. C. C. Warren, may justly feel proud.

Electric Lighting in Berlin.

The experimental lighting of Unter den Linden, which I reported as in progress some weeks ago, is now terminated, writes a correspondent of *Industries*. It was found that with three rows of arc lamps the illumination was fairly good, but not so brilliant as that established for the last five years in the Leipzigerstrasse. As, for the credit of the town, it is considered necessary that Unter den Linden should be the best lighted street of the metropolis, the town council has resolved to improve the effect of the electric lamps by adopting a light mosaic paving, in lieu of the present gravel path, from which the light will be better reflected; also to widen the central promenade, and to lay out strips of turf on either side. Herr Zacharias, an electrical engineer of this town, has introduced an apparatus for automatically recording the pressure kept in the mains of an electrical supply system which is in use here with very satisfactory results The apparatus, which has been made by Messrs. Siemens & Halske, consists of an ordinary clock with a pendulum making eighty beats per minute, and which closes every forty-five seconds an electric contact, throwing an electro-magnet into circuit. The armature of this magnet is balanced by a spring, so as to occupy a definite position when the standard pressure of 120 volts is in the mains. If the pressure is either greater or smaller, the armature occupies positions to either side of the normal. The armature is provided with a pin, in front of which slowly revolves a cylinder carrying a paper strip, with a line marking the position which corresponds to 120 volts. At the moment of making contact with the electro-magnet, the current is also sent through another electro-magnet, which presses the cylinder for an instant against the pin on the armature of the first magnet, and thus a hole is pricked, and the position of it on either side of the 120 volt line shows the variation of pressure existing at the moment. After a few seconds the current is again interrupted, and the same cycle of operations is repeated every forty-five seconds; thus a series of marks is obtained on the paper strip, forming a record. Herr Zacharias also tried to obtain an absolutely constant record, by keeping the paper strip always up to the pin; but this not proving successful, the plan of recording at short intervals was adopted.

—— The Clinton (Mass.) Gas Light Co., using the Schuyler system, has decided to put in the Brady mast arm, and the first invoice was shipped last week by the Schuyler Co.

—— The Albany Electric Illuminating Company will introduce the Westinghouse alternating system in that city. The foundation for a 2,500 light plant has been laid. The building will be ready for the electric and steam plant about February 1st.

Salem Electric Light and Power Company.

To the Editor of Electrical Review:

December 31st, you noticed in your valuable paper our contract for electric lighting. Since then our city council has, with our consent, changed from arc to incandescent street lighting. We now contract to put in 330 25 c. p. lamps, 25' high, which is thought here to be much better distribution than the 55 1,200 c. p. arcs would have been, and the town much better lighted. The price in either case being $4 000 per year.

April 1st next will no doubt see whether we are right in believing so.

D. L. D.

Salem, Ohio, Jan. 9th, 1888.

—— The Napa Electric Light Company, Napa City, Cal., has been incorporated. Capital stock, $50,000. Geo. L. Henzel and others, incorporators.

—— A. Whitney & Sons, Philadelphia, car wheel manufacturers, have recently installed a plant of the American system in their works. Philadelphia is waking up quite thoroughly on the advantage of the electric light.

—— The Waxahachee (Texas) Electric Light, Power and Water Co., has just been organized; capital stock $50,000. The company will proceed at once to put in 250 incandescent lights and 15 arc, with tower. A street railway company has also been chartered, and, if proper franchise can be had from city, work will begin at an early day.

—— The large Schuyler dynamo which was built by the Piedmont Exposition, and which was purchased by the Mission Ridge Land Company after taking the first prize at the big Atlantic Fair, has been put in position at East Lake, Tenn., and will be in operation by January 15th, when the entire lake grounds and all the streets and avenues leading to it will be lighted with arc lights. The dynamo operates thirty-five arc lights, besides enough incandescents to supply all the houses at the lake or in the vicinity.

—— The new cruiser "Chicago" is now being fitted out for service at the Brooklyn Navy Yard. The electric plant is already installed, and consists of two Edison compound dynamos, each for 350 lights, driven by Armington-Sims engines. Lead-covered cables have been used throughout the ship, the total length of circuits being about 40,000 ft. The cables are laid in wood casing, and Edison water tight cut-outs are fitted to every lamp, and all the switches employed are also water tight. The total insulation of the circuits is about 100,000 ohms.

—— One of the principal thoroughfares of St. Petersburg will be experimentally lighted by naphtha gas with a new form of large lamp. It is expected that the cost of lighting by this means will be less than with coal gas, and that the light will be more brilliant. At the present prices of kerosene this illuminant is by far cheaper for street lighting than any other kind of light. At St. Petersburg the cost of gas lighting is 3 times, that of electric lighting 7.3 times, and that of candle lighting 23 times as high as the cost of lighting by kerosene. At Moscow the difference is still greater, the figures being 6.2, 10.4, and 34 4 for gas, electric light, and candles respectively.

—— A jewelry storekeeper is thus quoted in the *Jewelers' Weekly:* "Surprised to see my watch repairers working by incandescent lamps, are you? Well, just let me say right here that there never was a better light invented for the purpose. The illumination is never disturbed by the slightest flicker, every wheel and pinion in the movement stands out as plainly again as it does under lamp light, and, in fact, the workmen prefer it to daylight to work by. It has hardly come into general use yet, but it will make a convert of anybody who tries it, and to any of the workmen who are obliged to call in the aid of lamps during the greater part of the time, it will be a revelation. Just at present I think I am about the only user of electricity for the purpose, but I do not believe I shall have the honor long."

Electric Light News

—— The Citizens' Electric Light Company, New Albany, Ind., will erect a plant.

—— C. F. Shower is interested in an electric light plant to be established at Carlisle, Pa.

—— Herman Wells is interested in an electric light plant to be established at Pottstown, Pa.

—— C. H. Dexter & Sons will erect an electric light plant at their mills at Windsor Locks, Conn.

—— The Schuyler Electric Co. have sold to the Newark Schuyler Electric Light Co. a thirty-five light arc plant.

—— The Whitefish Bay street railway, Milwaukee, Wis., intends to adopt the storage battery as a motive power.

—— Orangeville, province of Quebec, desires the electric light. Town clerk Hughson has the matter of bids in charge.

—— The Thomson-Houston system of electric light has been put in Richford, Vt. and a stock company has been formed.

—— Messrs. Holmes, Booth and Haydens report a very large sale of their patent "K. K." wire to electric light companies.

—— The Piscataquis Woolen Company contemplate the establishment of an electric light plant at their mill at Guilford, Me.

—— George L. Thompson and F. L. Downs are interested in an electric light plant to be established at Medina, N. Y.

—— The Valparaiso Gas, Electric Light and Fuel Company, Valparaiso, Ind., has been incorporated, with a capital stock of $50,000.

—— The Electrical Engine Company, Newark, has been incorporated. Capital stock, $100,000. Henry M. Paine and others, incorporators.

—— The Rutland Electric Company, Rutland, Vt., have increased its capital stock by $25,000, and will make extensive improvements to its plant.

—— The Berkley Electric Light Company, Berkley, Cal., has been incorporated. Capital stock, $30,000. R. P. Thomas, and others, incorporators.

—— The Seward Electric Light and Power Company, Seward, Neb., has been incorporated. Capital stock, $10,000. John Cattle and others, incorporators.

—— The Mahanoy City Light, Heat and Power Company, Mahanoy City, Pa, has been incorporated. Capital stock, $15,000. W. L. Yoder, and others, incorporators.

—— The Conshohocken Electric Light and Power Company, Conshohocken, Pa., has been incorporated. Capital stock, $20,000. T. H. Seeble, and others, incorporators.

—— The Union City Electric Light, Gas and Water Works Company, Strong City, Kas., has been incorporated. Capital stock, $10,000. W. P. Martin, and others, incorporators.

—— The Wichita Schuyler Electric Light Co. of Wichita, Kan., has just been awarded a three years' contract for lighting the streets, with an order for a large number of additional lights.

—— To "A. M. P.": No; the boilers that exploded at the Westchester, Pa, electric light station, were not the Babcock and Wilcox boilers. So far, we believe, this firm's boilers have to meet with their first explosion.

—— The body of a boy drowned at Winchendon, Mass., was found through the use of the electric light, a bulb being fastened to a pole and submerged, illuminating the water for a considerable distance in the neighborhood. The electric light promises to become an important aid in all manner of submarine operations.

ELECTRICAL PATENTS

(Copies of any Patents in the following List will be sent to any address on receipt of twenty-five cents.)

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JAN. 10, 1888.

376,060 Telephone transmitter; Seth E. Beedy, Farmington, Me., assignor of one-fourth to Daniel W. Austin and John J. Linscott, same place.

376,071 376,072 Electric circuit breaker: William R. Cole, Detroit, Mich., assignor to Parrish Bros. and the Peck Electrical Company, of same place.

376,116 Lighting cars by electricity; Arthur D. Stevens, Minneapolis, Minn., assignor of one-half to Edgar B. Dillingham, same place.

376,120 Dynamo electric machine or motor; Elihu Thomson, Lynn, Mass.

376,121 Electric lock; Charles A. Tucker, Islip, N. Y., assignor to the Tucker Electrical Manufacturing Company, of New York.

376,138 Fire-alarm circuit: John P. Barrett, Chicago, Ill.

376,149 Receiving, transmitting and distributing instrument for electro-magnetic thermoscopes; Henry J. Haight, New York, N. Y.

376,171 Annunciator; Jacob P. Tirrell, Somerville, Mass., assignor to the Electric Gas Lighting Company, Portland, Me.

376,228 Battery zinc; John Beattie, jr., Fall River, Mass., assignor to the Beattie Battery Zinc and Electrical Company, same place.

376,281 Pole indicator for electric conductors; August Berghausen, Elberfeld, Germany, assignor to E. Imhauser, Brooklyn, N. Y.

376,307 Dynamo-electric machine; Francis Jehl, Paris, France, assignor to the Societe Anonyme Compagnie Continentale Edison, same place.

376,323 Electric lamp; Luther H. Leber, York, Pa., assignor to Jacob G. Leber, same place.

376,326 Armature for dynamo-electric machines; Hermann Lemp, Hartford, assignor to the Schuyler Electric Company, Middletown, Ct.

PROPOSALS.

Contractors are hereby notified that Proposals will be admitted at the Ministerio de Hacienda, Madrid, Spain, up to the 7th of March proximo, for Lighting by Electricity the Theatre Royal.

For particulars, apply at this Consular Office.

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TESTIMONIALS.
Western Edison Light Co., H. WARD LEONARD, General Sup't.
W. J. Buckley, Mgr. Ft. Wayne Jenny El. Light Co.
Thomson-Houston Electric Light, Herbert Wadsworth, Manager Western Office.
Brush Electric Co., Alex. Kempt, Special Agent.
Excelsior Electric Co., C. J. Reilly, Western Mgr.
Sperry Electric Light Motor & Car Brake Co., 201 Royal Insurance Building.
J. H. Reid, General Manager of the Mather Electric Light Co., Chicago.
Wm. H. Purdey, Comm. of Public Works, Chicago
John Mab, Chief Engin'r of Board of Trade, Chic.
C. J. Meimes, Gen'l Sup't Thomson-Houston Light, Omaha, Neb.
J. A. Corbey, St. Joe Electric Light and Power Co., St. Joe, Mo.
Wm. Oswald, Agt. Edison Light Co., New Orleans, La.

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